THE GEOGRAPHICAL DISTRIBUTION OF SOUTHERN AFRICAN HYDROIDS

By

N. A. H. Millard

South African Museum, Cape Town

(With 9 figures, 8 tables and 2 appendices)

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ABSTRACT

The geographical distribution of 251 species of hydroid Cnidaria round the coast of southern Africa is analysed by means of a system of radial sectors. It is concluded that there is no distinct west coast fauna as such, but that a boundary zone exists at approximately 31°S latitude between an east coast region with mainly tropical affinities and a temperate west-plus-south coast region with a reduced tropical component and a large endemic population. The main centre of the endemic population is the Agulhas Bank. The relationships of the tropical species are mainly with the Western Indian Ocean Province and the Indo-West-Pacific Region. Deep-water species (45) which occur below 400 m are of a mixed nature and show no clear relationship with other parts of the world. Deep-water species are classified into stenobathic/eurybathic and stenothermic/eurythermic categories, and their distribution relative to water temperatures is discussed.

CONTENTS

INTRODUCTION

This paper is an attempt to analyse the distribution of the hydroid fauna of the coast of southern Africa as documented in a recent monograph (Millard 1975). Since the latter went to press a few more taxonomic papers on, or lists of, hydroids have appeared, namely Arnaud *et al.* (1976), Beurois (1975), Calder (1975, 1976), Cooke (1975), Cornelius (1975*a*, 1975*b*), Mergner & Wedler (1977), Millard & Bouillon (1975), Millard (1977*a*) and Watson (1975). Among

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these are records which extend the range of some South African species and they have been taken into account in the analysis which follows, as also have records from Buchanan (1957), Michel (1974), Blanco (1967, 1968, 1973, 1974) and Blanco & Bellusci de Miralles (1972*a*, 1972*b*), which have only recently become available to the author.

Within the borders of southern Africa, here taken to be the 20° parallel of south latitude, several new distribution records from deep water off the Natal coast and some new records for the country were published by Millard (1977*b*). There are also scattered identifications by the author, as yet unpublished, which are listed in Appendix 1.

The following changes in name have been adopted here:

Antennella africana Broch, 1914, to *A. quadriaurita* Ritchie, 1909, *fide* Millard (1977*b*: 123).

Eulaomedea calceolifera (Hincks, 1871) to *Campanularia calceolifera* Hincks, 1871, *fide* Cornelius (1975*a*: 254).*

Lafoea fruticosa (M. Sars, 1851) to *Lafoea dumosa* (Fleming, 1820) *fide* Cornelius (1975*b*: 385).

Obelia bicuspidata Clarke, 1875, to *O. bidentata* Clarke, 1875, *fide* Cornelius (1975*a*: 260).

Any zoogeographical analysis is aimed at pinpointing population changes within an area, and, if possible, relating them to physical or chemical factors and determining relationships with other areas. Such an analysis is subject to certain unavoidable weaknesses—the assignment of species to categories or components is largely subjective; numbers of species within categories are liable to change as more records are forthcoming (for instance some of the South African endemics may in time be expected to turn up outside our boundaries); and numbers of species may be influenced by different intensities of collecting in different areas or by misidentifications. The longer we wait the more reliable will be the results, but results, if only interim ones, are needed now. The larger the number of species involved the more meaningful will be the conclusions. One must bear in mind that it is the main trends which are significant rather than the details.

METHODS

The first step in the analysis was to remove all doubtful records and incomplete identifications. This left a total of 251 species.

The first objective was an analysis of distribution within the borders of southern Africa, and for this some system of comparison was necessary. When dealing with the littoral zone it is a comparatively simple matter to convert the distance along the coast to a straight line, a method with obvious practical

* Cornelius pointed out that the type species of *Campanularia* is *Sertularia verticillata* Linnaeus, 1758, and not *Sertularia volubilis* Linnaeus, 1758, as previously thought (Millard 1975: 203). Since *S. verticillata* is a branched species the diagnosis of *Campanularia* given previously (Millard 1975: 203) must be altered to include branching forms, and *Eulaomedea* sunk in *Campanularia*.

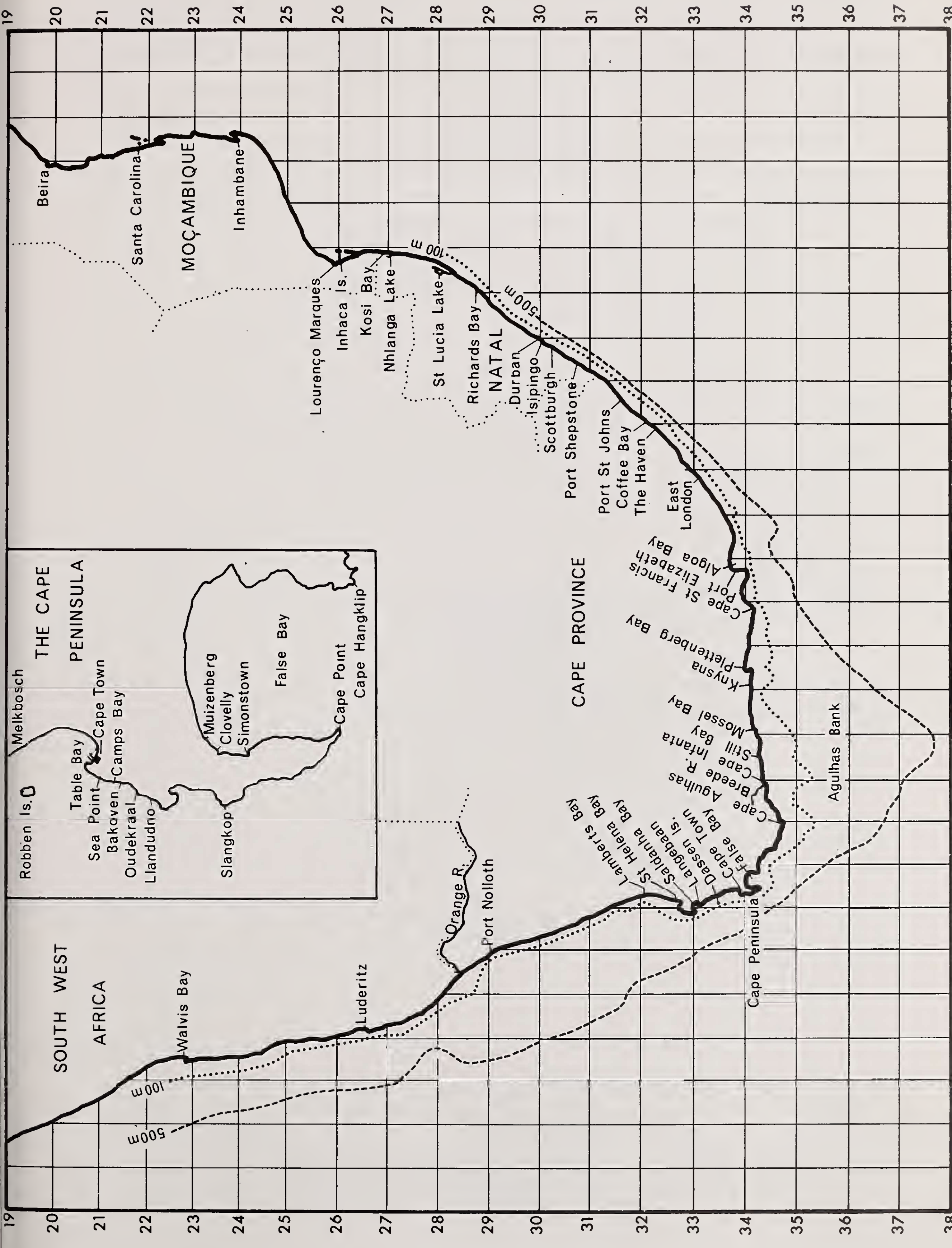


Fig. 1. Map of southern Africa showing the main collecting localities. From Millard (1975).

advantages, and this has been done by Stephenson (1947), Stephenson & Stephenson (1972), Day (1967) and others. However, when dealing with the sub-littoral area as well, this is clearly not possible for a continent of the shape of southern Africa. After much consideration the following arbitrary method was devised, in which the coastal waters were divided into thirty-six sectors of approximately equal area (Fig. 2).

The central point for the sectors was chosen as the intersection of the latitude line of 20°S and the longitude line of 24°E, a point which is approximately mid-way between the west and east coastlines. From this central point radii were drawn at 5° intervals, starting with one through the Cape Peninsula, and then working outwards in both directions. The sectors thus constructed were numbered 1–36. The reason for placing one radius (Number 14/15) through the Cape Peninsula is that Cape Point is generally recognized as an approximate zoogeographical boundary between the cold Benguela water on the west and the warmer Agulhas water on the east, and might be expected to have some significance. It so happens that another radius (Number 15/16) conveniently passes through Cape Agulhas, the most southerly point of Africa, and a third (Number 23/24) through the boundary between Transkei and Natal.

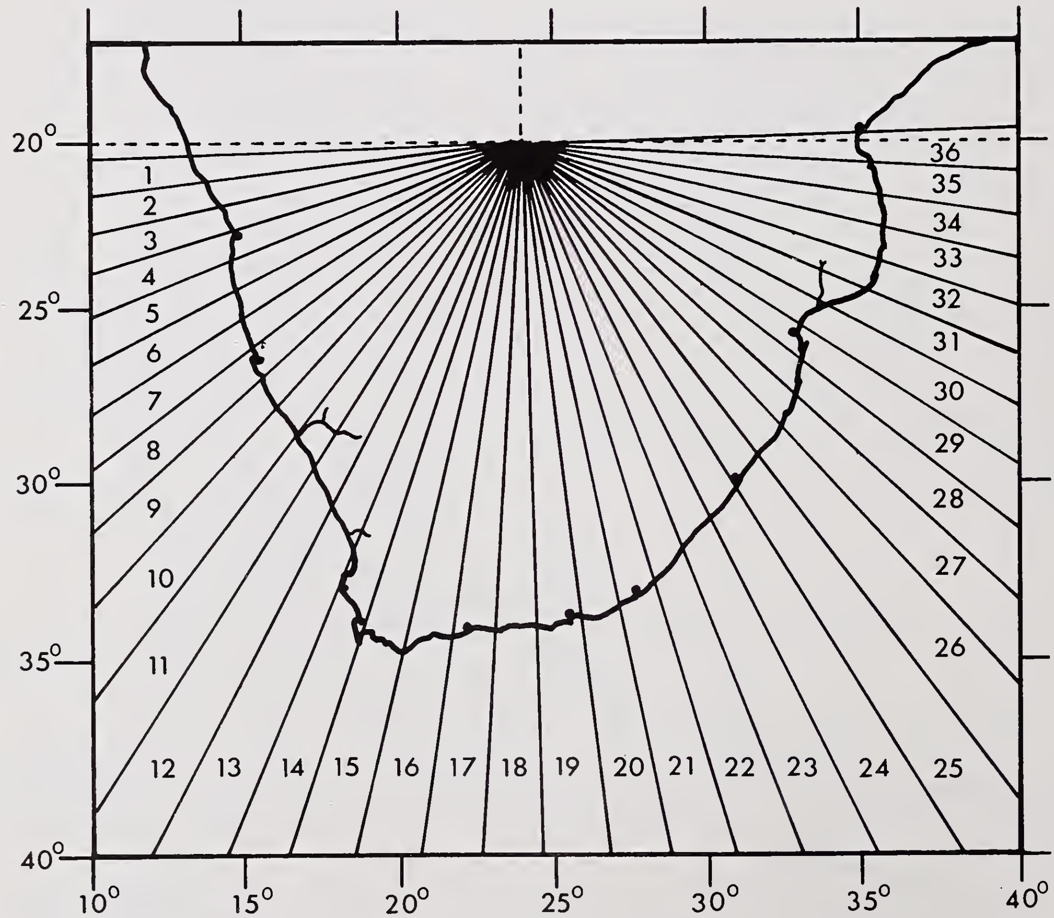


Fig. 2. Map of southern Africa illustrating the sector system which was used to analyse the distribution.

It must be emphasized that this is an arbitrary method, and obviously could not be applied to all coastlines, but it is felt that it might form a useful working method and basis for comparison with other southern African marine groups. It has the advantage that each sector covers an approximately equal area of sea and 'straight-line' length of coast and represents a cross-section through all depths. Since the sectors are roughly normal to the coast and the currents tend to follow the coast, each sector is affected in a similar way and population differences related to water temperature should be highlighted. It is felt that the advantages of this method at least outweigh the disadvantages (and impracticabilities) of the 'straightening-out' method of Stephenson.

The second objective was an analysis of the world-wide distribution of the southern African species, and for this the species were delegated to components defined as follows:

TROPICAL

Circumtropical. Present in the tropics of all three oceans, but may spread north or south into warm temperate seas as well.

Indo-West-Pacific Region. Stretching from the Suez Canal across the Indian Ocean and the East Indies into the Western Pacific as far as Hawaii and Easter Island. Includes northern Australia, Madagascar and East Africa. May spread into warm temperate seas as well.

Western Indian Ocean Province. The western section of the Indo-West-Pacific Region, bounded in the north by the Persian Gulf, and including Madagascar and surrounding islands.

TEMPERATE. (In a trial analysis it was found impossible to differentiate between cold temperate and warm temperate fauna when assessing world distribution.)

Antitropical (*bipolar*). Present in the temperate zones of all three oceans, and present in both the Northern and the Southern hemisphere, but not in the tropics except perhaps just at the edge.

Southern. Restricted to the temperate waters of the Southern hemisphere, but often in the subantarctic islands as well, and rarely reaching the Antarctic.

Atlantic. Restricted to the northern and/or southern temperate zones of the Atlantic, but absent from the tropics. May spread further north into the subarctic.

ENDEMIC

OTHER

Cosmopolitan. Present in all three oceans, and occurring in both tropical and temperate seas.

Scattered. Present in various regions, but not sufficiently widespread to be included in Cosmopolitan. Does not fit any other category.

A list of species, together with their components and distribution within thirty-four sectors, is given in Appendix 2. (Sectors 35 and 36 have been omitted as no records were available from this region.)

FAUNAL BOUNDARIES

It has long been recognized that the marine fauna of southern Africa includes both tropical elements, predominating on the east coast, and temperate elements, predominating on the south and west coasts. Most authorities, following Stephenson (1947) and Stephenson & Stephenson (1972), have recognized a separate east coast (tropical or subtropical) fauna, a south coast fauna (warm temperate) and a west coast fauna (warm or cold temperate) for the littoral region. These earlier views are summarized by Briggs (1974), who includes the east coast in the Western Indian Ocean Province of the Indo-West-Pacific tropical region; the south coast in the Agulhas Province of the South African warm temperate region; and the west coast as a separate South West Africa Province of the South African warm temperate region. Opinions have differed as to the position of the boundary between the east and south coast, and whether the west coast represents a separate faunal province, and if so whether it should be regarded as cold temperate or warm temperate.

The distribution of the faunal components of the continental shelf and the extent of the faunal regions is largely dependent on the ocean currents round the South African coast, in general the warm southward-flowing Agulhas Current being responsible for the southerly extension of tropical forms on the east coast, and the cold northward-flowing Benguela Current being responsible for the more northerly distribution of cool-water forms on the west coast. It is not intended to discuss these current systems in any detail here since accounts are available in most textbooks of marine biology (a concise general account is given by Stephenson & Stephenson (1972) and more recent contributions are summarized by M. J. Penrith (1976)).

In order to determine whether there is any region of the coast where a marked change in the hydroid fauna occurs, the range of the tropical, temperate and endemic components was plotted separately (Fig. 3). (The range of species was used in preference to presence/absence, in order to minimize differences in collecting intensity.) This figure emphasizes the tropical nature of the east coast fauna, for there is a strong tropical component at the northern end which gradually drops away, until beyond St Helena Bay on the west coast (Sector 14) only one species remains for a short distance. The *rate* of disappearance is greatest at the boundary of Sectors 23/24, and is also high in the region of Sectors 13/14/15. The temperate and endemic components are both highest on the south coast, falling away fairly evenly to the north-east, but more sharply to the north-west in the region of Sectors 13/14/15. A similar trend appears when the range of species is plotted as a percentage of the total range (Fig. 4).

It is thus possible to distinguish two 'zones of change', though they are not as marked as might be expected. The first (Sectors 23/24) provides a convenient

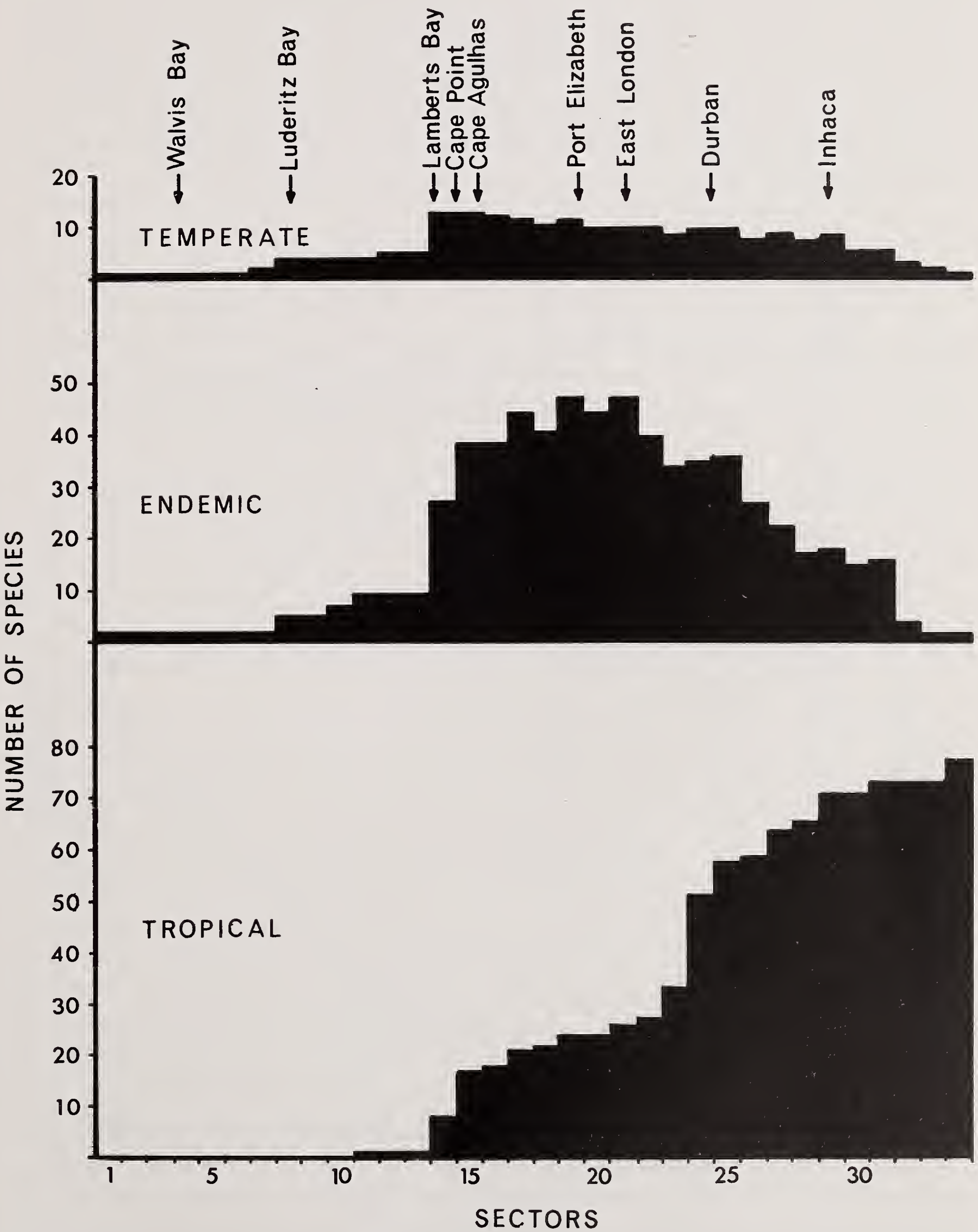


Fig. 3. The distribution of the temperate component (above), the endemic component (centre) and the tropical component (below). From range of species.

boundary between the east and south coast fauna. It is located between 30 and 32°S latitude, i.e. the stretch of coast between the Bashee River in the south and Durban in the north. For the discussions which follow, the boundary between Sectors 23 and 24 is used (31°S). This is more or less in agreement with conclusions drawn from other faunal groups. Stephenson & Stephenson (1972) suggest a boundary zone between Port St Johns and Qolora, i.e. at about 32°S, for the intertidal fauna (the form of the graph of the tropical component in Figure 3 of this paper is very similar to that for the intertidal fauna in Stephenson & Stephenson (1972, fig. 8.26)); J. L. B. Smith (1949) and M.-L. Penrith (1970) suggest the Great Kei River at 32°42'S for the fishes, and Day (1967) suggests the Bashee River at 32°15'S for the benthic Polychaeta.

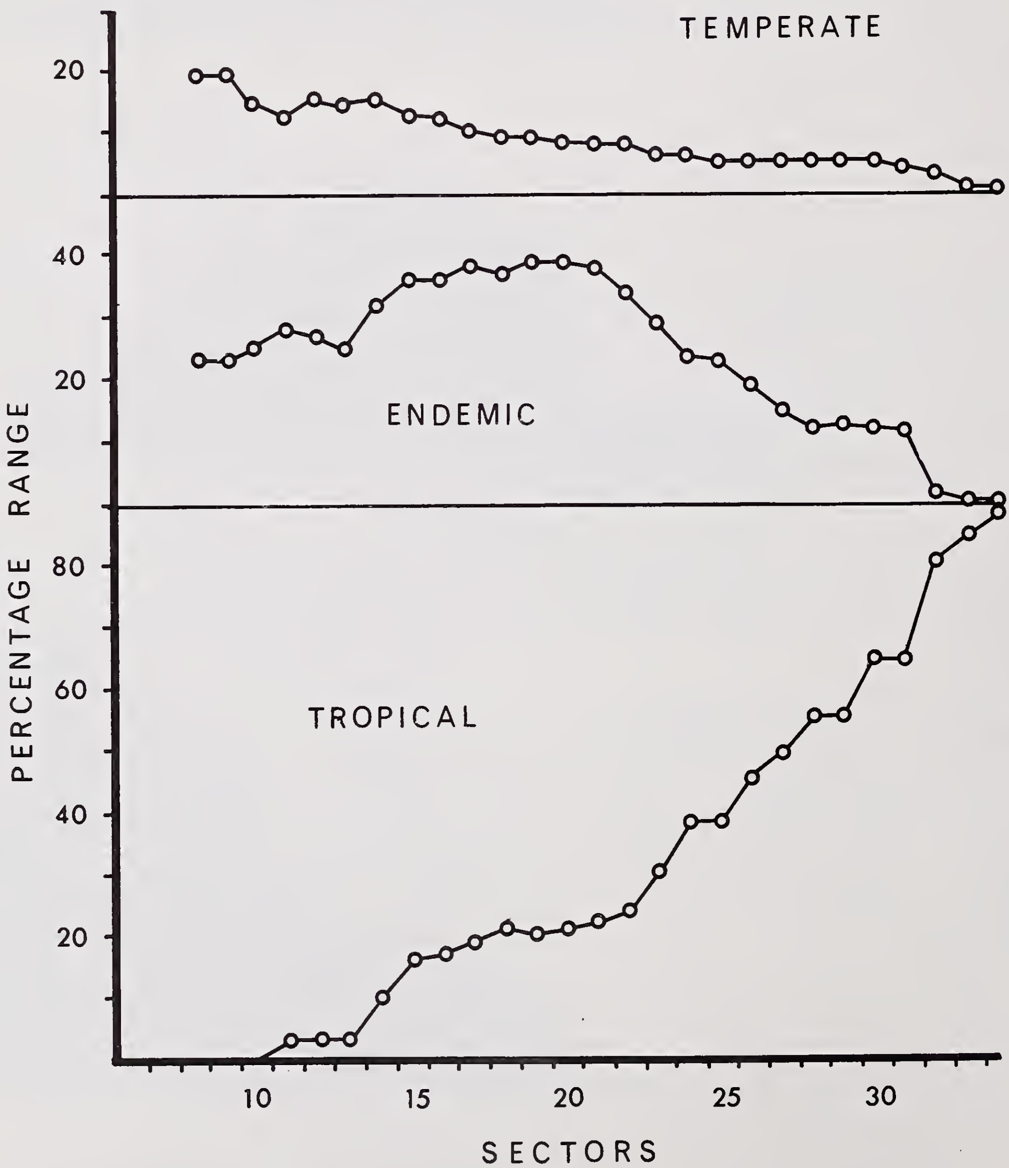


Fig. 4. The distribution of the temperate, endemic and tropical components, from range of species as a percentage of the total range. Sectors 1–7 have been omitted since the total number of species is less than twenty and the percentages unrealistic.

At the boundary of Sectors 23/24 the monthly minimum surface temperature near the coast does not fall below 16°C, the maximum does not rise above 27°C and the mean ranges from 21 to 24°C (U.S. Naval Oceanographic Office 1967). This is approximately the region where the Agulhas Bank begins to widen and force the warm Agulhas Current offshore. Further south the latter is separated from the coast by a cooler counter-current flowing northwards.

The usefulness of the second 'zone of change' in the south-westerly corner of the Cape Province (Sectors 13/14/15) is more debatable. It could be used to divide the temperate region, which stretches from north of 20°S on the west coast to 30–32°S on the east coast, into two provinces, if warranted by the fauna.

To test this an arbitrary boundary was placed at Cape Point (Sector 14/15) and the composition of species on the two sides of it compared with one another and with the east coast (Table 1). (Cape Point was used as a boundary by Stephenson (1947, fig. 3), Ekman (1953) and Briggs (1974).) It may be noted from Figures 3 and 4 that there is no evidence of a change in fauna at Cape Agulhas (Sector 15/16), the most southerly point of Africa).

TABLE 1

Analysis of fauna of west coast, as compared with that of the south and east coasts (actual records, not range).

Component	West coast (Sectors 1–14)		South coast (Sectors 15–23)		East coast (Sectors 24–36)	
	No. of species	%	No. of species	%	No. of species	%
Tropical	8	9,6	30	19,0	72	39,6
Temperate	13	15,7	20	12,7	12	6,6
Endemic to area	2	2,4	21	13,3	17	9,3
Endemic to more than one area	25	30,1	41	25,9	30	16,5
Cosmopolitan	17	20,5	21	13,3	28	15,4
Scattered	18	21,7	25	15,8	23	12,6
Total	83	100,0	158	100,0	182	100,0

It is apparent from Table 1 that the west coast fauna consists mainly of endemic, cosmopolitan and scattered species. The tropical species diminish in number round the coast from east to west; only 8 species remain on the west coast and these are all absent north of St Helena Bay. The temperate species of the west coast are fewer in number than those of the south coast. Only 2 of them (*Clavopsella navis* and *Gonothyraea loveni*, both from Table Bay harbour and probably introduced by ships), and possibly a third (*Sarsia eximia*), are restricted to the west coast. Only 2 rare species are endemic solely to the west coast (*Myriothela tentaculata* and *Eudendrium ritchiei*), whereas 21 are endemic to the south coast and 17 to the east coast. Of the cosmopolitan and scattered components only 3 (*Acryptolaria crassicaulis*, *Hybocodon unicus* and *Hydrodendron gracilis*) have been recorded from the west coast alone.

In total, thus, the west coast has only 8 unique species (9,8 %), of which only 2 (2,4 %) are endemic to the area. Briggs (1974) requires at least 10 per cent endemic species for the designation of a separate province, and on this basis the west coast of South Africa does not qualify, at least for the hydroids. The hydroid fauna of the west coast seems to be mainly an impoverished south coast fauna.

Although Day (1967) accepted a separate west coast element for the littoral polychaets, he could find no marked difference between the south and west coasts for the sublittoral ones, and ascribed this to the fairly uniform water temperature on the bottom of the continental shelf (he gave figures of 12–14°C at 100 m from Port Elizabeth to Lüderitz, but the records collated by Hulley (1972) show a somewhat lower range of 8–13°C at 100 m between 20°S on the west coast and Port Elizabeth on the south coast). On the other hand there *is* a difference in the surface water temperature on the two sides of Cape Point (Day gives a range of 15–20°C for the south coast and 12–15°C for the west coast, but under certain conditions and for certain periods the south coast temperature may drop to as low as 11°C (during local upwelling) and rise as high as 24°C, while that of the west coast may drop to 9°C (M. J. Penrith 1976)). In this respect it might be noted that all hydroids are sublittoral in the sense that they cannot withstand drying and survive in the littoral zone only in damp overhangs or open runnels.

None of this really explains why there should be a diminution of hydroid species on the west coast and practically no endemic population of cold-temperate forms. Ekman (1953) associates the poverty of the benthos of the 'Namaqua coast' with the hydrogen sulphide resulting from frequent upwelling and red tides. Briggs (1974) suggests that certain species are prevented from spreading westwards round Cape Point by the absence of high summer temperatures for reproduction (he gives a February mean of 16–18°C for South West Africa as against one of 20–22°C for the south coast, but compare remarks in parenthesis above). M.-L. Penrith & Kensley (1970*a*) suggest that a region of minimal temperatures between Hondeklip Bay and Lüderitz (i.e. north of St Helena Bay) acts as a barrier to the establishment of southern warm-temperate intertidal species further north. The paucity of hydroid records on the west coast may be partly a reflection of the difficulty of collecting on the exposed and inhospitable Skeleton Coast. However, M.-L. Penrith (pers. comm.), who has collected in this area, feels that the poverty is a real one, and perhaps linked to the absence of suitable habitats such as sheltered coves, rock pools, etc., and the preponderance of surf beaches and sandy floors. The harsh conditions and poverty of the rocky-shore fauna are also emphasized by M. J. Penrith (1976).

There is no evidence at all of a southward spread of species from tropical west Africa. The southern boundary of the west African tropical region is too far north for consideration in this paper (14 or 15°S: Briggs 1974; 18–22°S: Hulley 1972). M.-L. Penrith & Kensley (1970*b*) found the first of the west African littoral species at Rocky Point (18°59′S).

In conclusion the south and west coast sublittoral areas are considered to represent a single temperate province for the hydroid fauna, which might be termed the Agulhas/Namaqua Province, the centre of the endemic population being on the Agulhas Bank.

THE TROPICAL COMPONENT

Of the total number of 251 species, 77 (30,7 %) can be classified as tropical. Of these, 20 are circumtropical, 24 Indo-West-Pacific and 33 confined to the Western Indian Ocean. In addition there are 17 endemic species which are confined to the South African east coast, and therefore with tropical tendencies (these were termed 'subtropical endemics' by Day (1974)). (Appendix 2.)

Ekman (1953) and Briggs (1974) consider that the main centre of origin of the tropical fauna is the Indo-Malayan Region. From here species tend to spread west to the Indian Ocean (and may penetrate into the Red Sea or round southern Africa), and to a lesser extent east to the Eastern Pacific.

Species have been classified here as Indo-West-Pacific or Western Indian Ocean even though a few have one or two records outside these areas. Thus, 2 have penetrated into the Mediterranean (*Corydendrium parasiticum*, *Thyroscyphus fruticosus*), 4 have reached the tropical west coast of Africa (*Abietinaria laevimarginata*, *Campanularia africana*, *Corydendrium parasiticum*, *Sertularia ligulata*), 1 has reached tropical South America (*Dentitheca bidentata*), and 1 has reached southern Australia (*Dynamena obliqua*). Further spread would produce a circumtropical distribution, but of the species classified as such no less than 13 have failed to reach the east coast of the Pacific, and this applies also to 4 of the cosmopolitans (Table 2). There is therefore support for Briggs's contention (1974) that the 'East Pacific barrier' is one not easily crossed.

There is some evidence for a secondary centre of origin in the Western Indian Ocean, for in addition to the seventeen South African subtropical endemics (i.e. present on the east coast only), there are seven Western Indian

TABLE 2

List of circumtropical and cosmopolitan species which do not occur on the east coast of the Pacific.

Circumtropical	Cosmopolitan
Diphasia digitalis	*Antennella secundaria*
Dynamena quadridentata	*Cladocoryne floccosa*
Gymnangium hians	*Coryne pusilla*
Halecium dyssymetrum	*Halecium sessile*
Hydrodendron caciniformis	
Idiellana pristis	
Monostaechas quadridens	
Plumularia strictocarpa	
Scandia mutabilis	
Sertularella diaphana	
Sertularia distans	
S. marginata	
S. turbinata	

Ocean species which, though absent from the Indo-Polynesian area, have yet penetrated into the Red Sea (*Clytia latitheca*, *Cytaeis nassa*, *Diphasia heurteli*, *Halopteris glutinosa*, *Hydractini kaffraria*, *Plumularia wasini*, *Solanderia minima*).

Some communication between southern Australia and the Western Indian Ocean is indicated, since there are five species common to the two, namely *Amphisbetia maplestonei*, *Crateritheca acanthostoma*, *Halopteris glutinosa*, *Sertularella arbuscula* and *Synthecium dentigerum*. These occur nowhere else (except for *H. glutinosa* which also occurs in the Red Sea) and the likelihood is that the movement has been from west to east with the West Wind Drift.

THE TEMPERATE COMPONENT

The total temperate component includes 28 species (11,2%), of which 11 are antitropical (bipolar), 10 are restricted to the Southern hemisphere and 7 are restricted to the Atlantic (Appendix 2). These are species which cannot survive the high temperatures of the tropics, although some can spread into the cooler waters of the subpolar regions. The southern species must have evolved in the south, but the antitropical and Atlantic species may have evolved in either the south or the north and must at some time have crossed the tropics. This may have been achieved by equatorial submergence, for Briggs (1974) points out that the tropical surface water is only about 30–40 m deep in the Eastern Atlantic. It may also be due to transportation on the hulls of ships. In all, twenty-one species have been recorded on ships' hulls or floating objects such as buoys. The fauna of ships' hulls is a characteristic group of hardy species (Millard 1952), most of them cosmopolitan. Three of the species (all belonging to the temperate component) are known only in harbour areas in South Africa, and it is suggested that these are recent introductions by ships:

Gonothyraea loveni is well established in Cape Town docks, occurring abundantly on pylons, cables, etc., as well as on hulls of ships. It has not been reported from any other part of South Africa. Elsewhere it is known from the North Atlantic, New Zealand, Tasmania and the Argentine.

Campanularia calceolifera has been found, and reproducing, in Cape Town docks on a barge and on a raft, neither of which had left the harbour. It must, therefore, be established, though not common. It is not known for certain elsewhere in South Africa, a record from False Bay by Stechow (1925) being of infertile material and thus subject to doubt. The species is well known on European and Mediterranean coasts and also occurs on the east coast of North America.

Clavopsella navis is known from a ship's hull in Cape Town docks, and also from the Kiel Canal (Thiel 1962 as *C. quadranularia*). The latter is probably the original locality since the colonies there were more abundant and better developed.

Since all these three species occur both in the South and North Atlantic they must have traversed the tropics, though they have not established themselves in tropical latitudes so far as is known. They may have been hardy enough to survive a brief passage through warmer waters on ships' hulls, or they may have died back during transport, leaving the hydrorhiza to regenerate again in suitable temperature conditions. Ralph (1961) also found evidence of the introduction of hydroids by ships' hulls to New Zealand harbours.

It is interesting to compare the relations of the temperate species with the other two southern continents. From Table 3 it can be seen that South Africa has 9 species in common with southern Australasia alone, but only 3 species in common with South America alone. There are 7 species common to all three.

TABLE 3

Temperate species common to the southern continents.

South Africa and South Australasia	South Africa and temperate South America	Temperate part of all three southern continents
Kirchenpaueria triangulata	*Phialella turrita*	*Amphisbetia minima*
Nemertesia ciliata	*Sertularella striata*	*Filellum antarcticum*
Parascyphus simplex	*Symplectoscyphus paulensis*	*Gonothyraea loveni*
Plumularia obliqua		*Nemertesia cymodocea*
P. spinulosa		*Plumularia filicaulis*
Sarsia eximia		*Staurocladia vallentini*
Sertularella annulaventricosa		*Tubularia larynx*
Stereotheca elongata		
Symplectoscyphus macrogonus		
(Total: 9)	(Total: 3)	(Total: 7)

This would suggest dispersal eastward from the Agulhas Bank. Beurois (1975) emphasized the role of eastward drifting kelp in the dispersal of attached forms to St Paul and Amsterdam Islands, and Arnaud *et al.* (1976) discussed the transport of South African fauna to St Helena on kelp. If the list in Table 3 is extended to include the cosmopolitan and scattered components and those tropical forms which have spread south of the Tropic of Capricorn, the relationship between South Africa and Australasia is more marked (34 species in common with Australasia alone, 10 with South America alone, and 26 in all three).

The distribution of those South African species which have antarctic or subantarctic affinities is given in Table 4. In all, 41 species are listed, a relatively small number (16,3 % of the total), and of these half (21) are cosmopolitan and this tends to mask the relationships. Without the cosmopolitan species only 20 (8,0 %) have antarctic affinities and of these 11 are classified as temperate. The absence from South Africa of certain common antarctic genera, such as *Staurotheca*, *Tulpa*, *Grammaria* and *Silicularia*, is very striking. On the whole there is very little evidence of relationship with the Antarctic.

TABLE 4

Distribution of species with antarctic/subantarctic affinities. The Magellan Region includes Gauss Station, the Falklands and South Georgia. The Kerguelen Group includes Marion, Prince Edward and Crozet Islands.

Species	Component	Antarctic continent and neighbourhood	Magellan Region	Tristan group	Kerguelen group	St Paul
Acryptolaria conferta	Cosmopolitan	×	×			
A. crassicaulis	Scattered	×	×			
Aglaophenia p. pluma	Cosmopolitan		×			×
Amphisbetia minima	Temperate (Antitr.)		×			×
A. operculata	Cosmopolitan		×		×	×
Antennella quadriaurita	Scattered			×		
A. secundaria	Cosmopolitan					×
Bimeria vestita	Cosmopolitan		×			
Bougainvillia macloviana	Scattered		×		×	
Campanularia crenata	Cosmopolitan		×			
C. integra	Cosmopolitan		×			
Clytia hemisphaerica	Cosmopolitan		×			×
C. paulensis	Scattered	×				×
Coryne pusilla	Cosmopolitan				×	
Dynamena cornicina	Cosmopolitan					×
Filellum antarcticum	Temperate (Southern)	×	×			
F. serratum	Cosmopolitan		×		×	
Halecium beanii	Cosmopolitan		×			
H. delicatulum	Cosmopolitan	×	×		×	
H. tenellum	Cosmopolitan	×	×	×	×	
Hincksella echinocarpa	Temperate (Southern)				×	
Hybocodon unicus	Scattered		×			
Kirchenpaueria triangulata	Temperate (Southern)				×	
Lafoea benthophila	Scattered	×	×		×	×
L. dumosa	Cosmopolitan	×	×		×	
Modeeria rotunda	Cosmopolitan		×		×	
Nemertesia cymodocea	Temperate (Southern)		×			
N. ramosa	Scattered		×			
Obelia bidentata	Cosmopolitan		×	×	×	
O. dichotoma	Cosmopolitan	×	×	×		×
O. geniculata	Cosmopolitan		×	×	×	×
Parascyphus simplex	Temperate (Antitr.)	×		×		
Phialella turrita	Temperate (Antitr.)		×			
Plumularia pulchella	Scattered		×			
P. setacea	Cosmopolitan		×			×
Sertularella leiocarpa	Temperate (Southern)			×		×
S. p. polyzonias	Cosmopolitan		×		×	
S. striata	Temperate (Southern)		×			
Staurocladia vallentini	Temperate (Southern)		×		×	
Symplectoscyphus paulensis	Temperate (Southern)		×			×
Zygophylax armata	Scattered			×		

THE ENDEMIC COMPONENT

The number of endemic species strictly belonging to the South African coast south of 20°S is 76. However, there are 2 species which also occur immediately north of 20° on the west coast (*Gattya humilis* and *Salacia articulata*). 4 species occur only in South Africa and the Vema Seamount (*Halopteris pseudoconstricta*, *Salacia articulata*, *Sertularella flabellum* and *S. megista*), and it was shown by Millard (1966) that the hydroid fauna of the Vema Seamount is essentially South African (21 of the 23 species also occur in South Africa). If these 6 species are included, the endemics number 82 (32,7% of the total of 251). It might be noted, however, that Mergner & Wedler (1977) have recorded *Eudendrium deciduum* and *Sertularella natalensis* from the Red Sea with a query.

As a comparison the following percentages of endemics have been given for other large marine groups in southern Africa. The figures are not strictly comparable, however, since the boundaries used for the 'Southern African Region' are not always the same.

Polychaeta	36%	(Day 1967)
Echinoderms, other than Holothuria	48%	(Clark & Courtman-Stock 1976)
Ascidians	*c.* 50%	(Millar 1971)
Fish	25,3%	(M. M. Smith 1970: 380 out of 1 500 species)

The south coast of southern Africa has more endemic species of hydroid than any other region, and the Agulhas Bank seems to be the centre of distribution of the endemic population (Figs 3–5).

There are only three genera endemic to South Africa, *Bicorona*, *Hydrocorella* and *Uniscyphus*, and all of these are monotypic. However, certain genera have a larger proportion of endemic species than others (Table 5). These are probably genera in which speciation is actively occurring in the South African area. They are also genera in which many of the species are not easily distinguished from one another, and thus pose constant problems to the systematist. Similarly, species with several subspecies are ones likely to be undergoing active speciation. Thus, *Thecocarpus flexuosus* has four subspecies; the nominal one is

TABLE 5

List of South African hydroid genera with the largest number of endemic species and/or subspecies.

Genus	Number of endemic species or subspecies	Total number of species or subspecies in South Africa
Cladocarpus	9	13
Corhiza	5	5
Halopteris	4	6
Hydractinia	3	5
Sertularella	14	23
Zygophylax	4	7

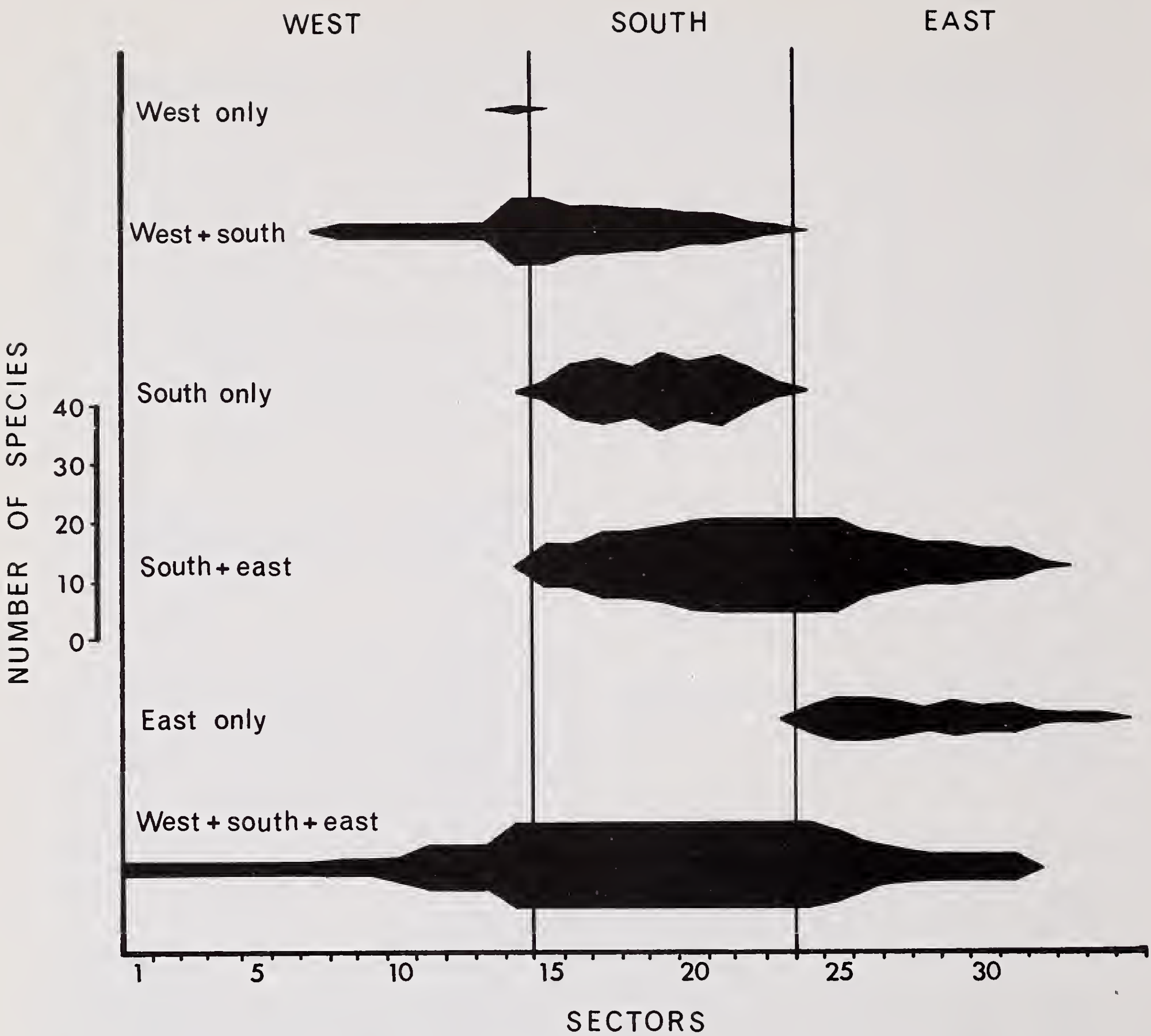


Fig. 5. An analysis of the distribution of the endemic species, with the total number of species distributed between six components, as in Stephenson (1972). From range of species.

tropical Indo-West-Pacific and the other three are endemic to southern Africa. *Sertularella polyzonias* also has four subspecies; the nominal one is cosmopolitan and two of the others are endemic to southern Africa.

Several common genera, on the other hand, have no southern African endemics: *Aglaophenia*, *Amphisbetia*, *Dynamena*, *Lytocarpus*, *Nemertesia*, *Obelia* and *Sertularia*.

THE COSMOPOLITAN AND SCATTERED COMPONENTS

The cosmopolitan species number 28 (11,2 %). They owe their wide distribution to the fact that they are eurythermic, hardy and adaptable. The wide distribution possibly indicates a very old history, in which there has been plenty of time to disperse.

Species classified as scattered or disjunct number 36 (14,3 %). Most of them

have odd distributions which do not fit any of the other categories. There are two possibilities. Either these are newly evolved eurythermic species which are in the process of spreading rapidly and likely to become cosmopolitan, or they are 'peripheral relicts' of fairly primitive forms which were once more widely distributed.

Among the scattered species three are interesting because outside southern Africa they are limited to the west and east coasts of the tropical Atlantic (*Clytia hummelincki*, *Zyzzyzus solitarius*) or to the western tropical Atlantic only (*Cladocarpus tenuis*). Three others have a similar distribution but also extend further north and/or east (*Aglaophenia latecarinata*, *A. pluma dichotoma*, *Symplectoscyphus amphoriferus*).

Cosmopolitan and scattered species with antarctic/subantarctic affinities are included in Table 4.

DISTRIBUTION AND DEPTH

Figure 6 shows that there are more species present in the shallow water (0–100 m) than at any other level, and although there have been fewer samples from deep water it is not expected that more extensive collecting will alter the picture to any great extent. The shallow water is obviously the optimum zone for hydroids. Most of the species in the littoral area are at the upper edge of

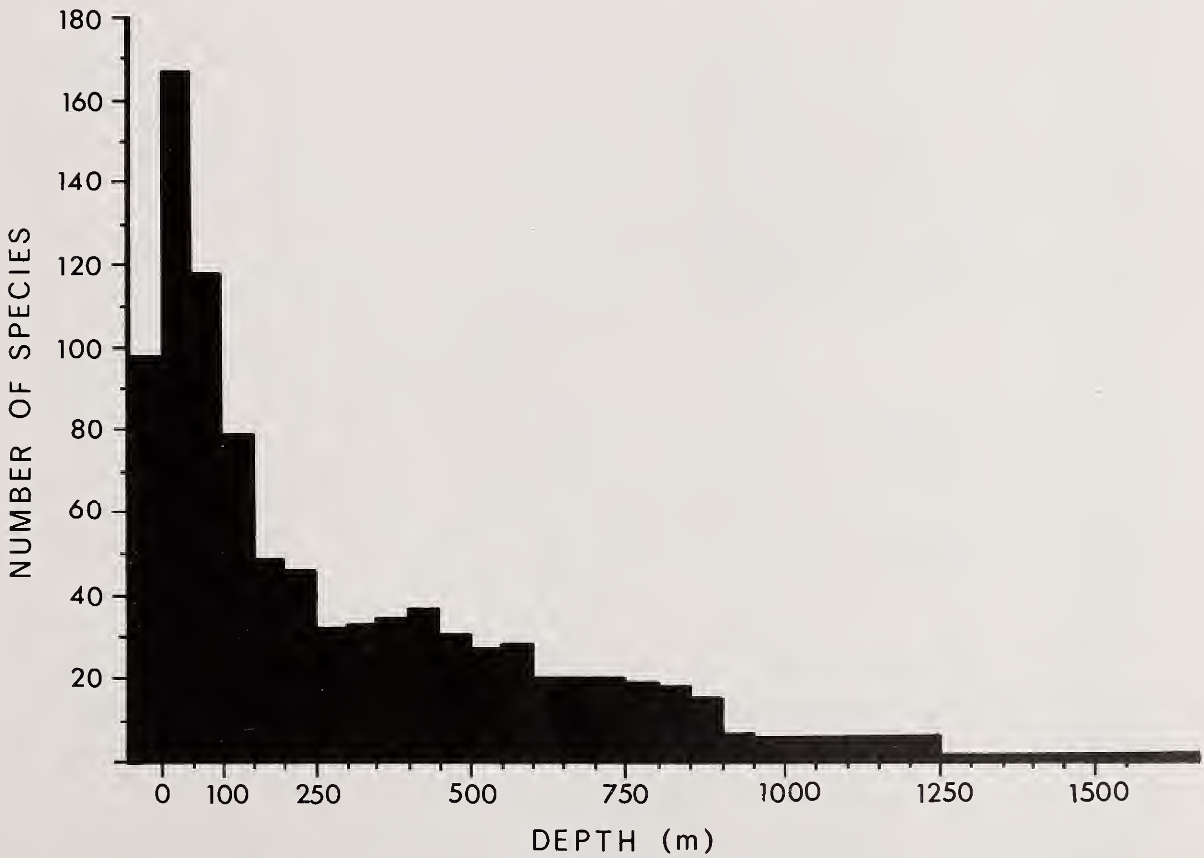


Fig. 6. The distribution of species according to depth. From range of species.

their depth range and able to survive only under overhangs and in rock pools and crevices. Only 24 of the 98 littoral species have not been found below low water of springs.

Deep-water species are those which occur over the edge of the continental shelf, and Ekman (1953) places an arbitrary upper boundary for the deep-sea fauna at 400 m. The number of hydroids known from below this depth round the South African coast is relatively small (45 = 17,9 %), and only eight of these reach 1 000 m (abyssal). The species are listed in Table 6.

These species can be divided into two arbitrary categories on the basis of their depth range both in South Africa and the rest of the world:

Stenobathic: those that are restricted to water deeper than 200 m.

Eurybathic: those that occur above and below 200 m.

These two categories are distributed between the different geographical components as follows:

	Stenobathic	*Eurybathic*	*Total*
Tropical	5	5	10
Temperate	1	4	5
Endemic	5	6	11
Cosmopolitan	0	9	9
Scattered	1	9	10
Total	12	33	45

All the (12) stenobathic species are in reality cold-water species frequenting water below about 16°C (Ekman 1953, table 42), and this includes five so-called 'tropical' species. These species are thus also stenothermic. Their limiting factor for distribution may be depth or temperature or a combination of both.

Some of the eurybathic species are also stenothermic. This applies to the following tropical and scattered species whose records *within the tropics* are never shallow, and which are thus restricted to cold water:

		Most shallow record in tropics (m)
Acryptolaria rectangularis	(tropical)	228
Cladocarpus tenuis	(scattered)	185
Cryptolarella abyssicola	(scattered)	4 560
Symplectoscyphus amphoriferus	(scattered)	161
Zygophylax sibogae	(scattered)	Only one tropical record: depth not given.

To the same category of eurybathic/stenothermic species might be added the endemic and temperate eurybathic species, at any rate those restricted to the south-west coast of South Africa and the east coast below 200 m:

Cladocarpus sinuosus (endemic): minimum east coast record 400 m.

Hincksella echinocarpa (temperate): minimum record Kerguelen 41 m, minimum east coast record 1 610 m.

TABLE 6

South African deep-water species.
SB—stenobathic (never recorded above 200 m); EB—eurybathic (occurring at all depths); ST—stenothermic (cold-water species); ET—eurythermic (occurring at all temperatures).

Species	Component	*Depth range in South Africa* (m)	*Depth range outside South Africa* (m)	*Component of depth/temperature*
Acryptolaria conferta	Cosmopolitan	64–1200	0–4400	EB/ET
A. crassicaulis	Scattered	2835	109–767	EB/ET
A. rectangularis	Tropical	110–1200	228–600	EB/ST
Antennella quadriaurita	Scattered	0–825	0–400	EB/ET
Branchiocerianthus imperator	Tropical	730	200–5290	SB/ST
Campanularia hincksii	Cosmopolitan	9–450	0–811	EB/ET
Cladocarpus distomus	Tropical	292–2200	55–1362	EB/ET
C. dofleini	Tropical	425–550	1019	SB/ST
C. inflatus	Endemic	495	—	SB/ST
C. millardae	Tropical	200–595	5020	SB/ST
C. natalensis	Endemic	400–900	—	SB/ST
C. sinuosus	Endemic	183–680	—	EB/ST
C. tenuis	Scattered	495	185–550	EB/ST
Clytia gravieri	Tropical	0–528	0–4243	EB/ET
Cryptolarella abyssicola	Scattered	100–2740	745–4970	EB/ST
Filellum serratum	Cosmopolitan	24–900	0–650	EB/ET
Garveia crassa	Tropical	625–900	741	SB/ST
Halecium beanii	Cosmopolitan	0–780	0–1134	EB/ET
H. sessile	Cosmopolitan	425–430	0–752	EB/ET
H. tenellum	Cosmopolitan	0–900	0–730	EB/ET
Halopteris glutinosa	Tropical	0–550	1–80	EB/ET
H. polymorpha	Tropical	0–900	0–89	EB/ET
H. tuba	Endemic	11–550	—	EB/ET
Hincksella echinocarpa	Temperate	1610–2200	41–109	EB/ST
Hydrocorella africana	Endemic	0–500	—	EB/ET
Kirchenpaueria triangulata	Temperate	111–1207	550–585	EB/ST
Lafoea benthophila	Scattered	425–430	672–3237	SB/ST
L. dumosa	Cosmopolitan	60–920	0–2200	EB/ET
Modeeria rotunda	Cosmopolitan	70–550	0–1240	EB/ET
Nemertesia antennina	Scattered	425–430	0–1779	EB/ET
N. ramosa	Scattered	11–700	0–872	EB/ET
Plumularia antonbruuni	Endemic	440	—	SB/ST
P. mossambicae	Endemic	110–550	—	EB/ET
P. setacea	Cosmopolitan	0–430	0–752	EB/ET
Sertularella leiocarpa	Temperate	200–900	183–672	EB/ST
Stegolaria geniculata	Tropical	775–850	253–910	SB/ST
Symplectoscyphus amphoriferus	Scattered	550–900	161–1256	EB/ST
S. arboriformis	Endemic	10–420	—	EB/ET
S. paulensis	Temperate	347–1200	400–672	SB/ST
Uniscyphus fragilis	Endemic	360–420	—	SB/ST
Zygophylax africana	Endemic	137–850	—	EB/ST
Z. armata	Scattered	48–440	183	EB/ET
Z. brownei	Temperate	400–550	20–752	EB/ET
Z. inconstans	Endemic	360–450	—	SB/ST
Z. sibogae	Scattered	88–900	146–550	EB/ST

Summary:		
	Cosmopolitan	9
	Scattered	10
	Tropical	10
	Temperate	5
	Endemic	11
	Total	45

Kirchenpaueria triangulata (temperate): minimum record Agulhas Bank 111 m, minimum east coast record 350 m.
Sertularella leiocarpa (temperate): minimum record Tristan 183 m, minimum east coast record 280 m.
Zygophylax africana (endemic): minimum east coast record 400 m.

For the (10) species in this eurybathic/stenothermic category the limiting factor is obviously temperature rather than depth.

The remaining (23) species are truly eurybathic and eurythermic, for they can occur in any temperature and at any depth. As might be expected, the majority (13) are cosmopolitan or scattered.

Hedgpeth (1957) suggested that all the deep-sea benthic population will eventually prove to be cosmopolitan, but it is clear from this analysis that geographically cosmopolitan species are not necessarily eurythermic.

The data for a selected group of 21 species were examined to see whether the depth distribution round the coast bore any relation to changing water temperatures. These were the species recorded from a minimum of 10 sectors and from depths extending below 100 m. Only 7 of the species so tested showed indications of an increasing minimum depth as one passes round the coast from west to east and then north; only 5 showed indications of an increasing maximum depth (Fig. 7, Table 7). This might be interpreted as an inability in a few species to survive in the warmer surface and shallow waters of the east coast. It is not surprising that none of these species belongs to the tropical component.

Cladocarpus is a characteristic deep-water genus, and 12 of the 13 South African species extend down below 100 m, 9 below 200 m, 3 below 500 m and 7 do not occur in water shallower than 200 m.

TABLE 7

The relationship between depth and distribution.
A. The minimum recorded depth in metres; B. The maximum recorded depth in metres.

Species	Sectors							Component
	0–5	6–10	11–15	16–20	21–24	25–30	31–35	
A. *Antennella quadriaurita*	—	35	0	9	50	100	—	Scattered
Halecium delicatulum	—	—	0	4	27	110	55	Cosmopolitan
Halopteris tuba	—	—	22	11	27	70	110	Endemic
Salacia articulata	0	23	0	10	0	18	110	Endemic
Sertularella flabellum	—	—	15	10	27	124	—	Endemic
Sertularella megista	—	—	0	10	27	49	110	Endemic
Symplectoscyphus arboriformis	0	10	11	11	49	124	—	Endemic
B. *Antennella quadriaurita*	—	40	79	114	210	825	—	Scattered
Salacia articulata	0	23	75	110	91	135	132	Endemic
Sertularella flabellum	—	—	99	200	91	232	—	Endemic
Sertularella megista	—	—	75	200	164	219	347	Endemic
Symplectoscyphus arboriformis	—	20	35	120	90	420	—	Endemic

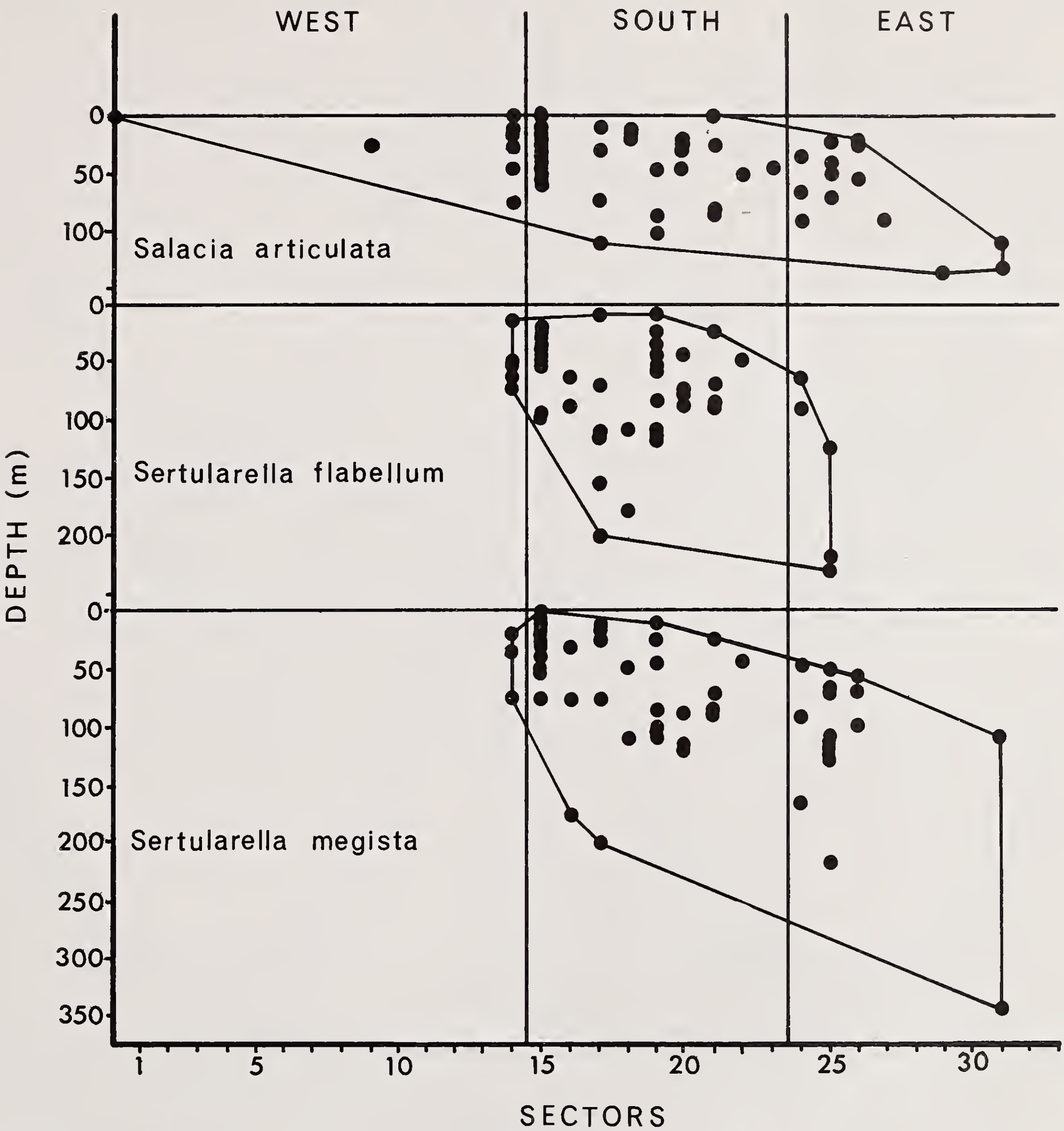


Fig. 7. The distribution according to depth of three species which show tendencies towards greater depths in warmer waters. Actual records.

ESTUARINE AND BRACK-WATER SPECIES

Although many hydroids penetrate into the mouths of estuaries, especially on rocky substrata, only two species are truly estuarine and have not been found in the open sea. These are *Bimeria fluminalis*, which grows on mangrove roots in Richards Bay and St Lucia estuaries, and *Hydractinia kaffraria*, which is a commensal on the shell of *Nassa kraussiana* and occurs in estuaries from the Breede River mouth on the south coast to Durban on the east coast.

The Limnomedusan, *Ostroumovia inkermanica*, is known from several brack-water lakes on the east coast, the hydroid from Lagoa Poelela, Mozambique, in a salinity of 8 parts per thousand, both hydroid and medusa from Nhlange Lake, Zululand, in 3–4 parts per thousand, and the medusa alone from

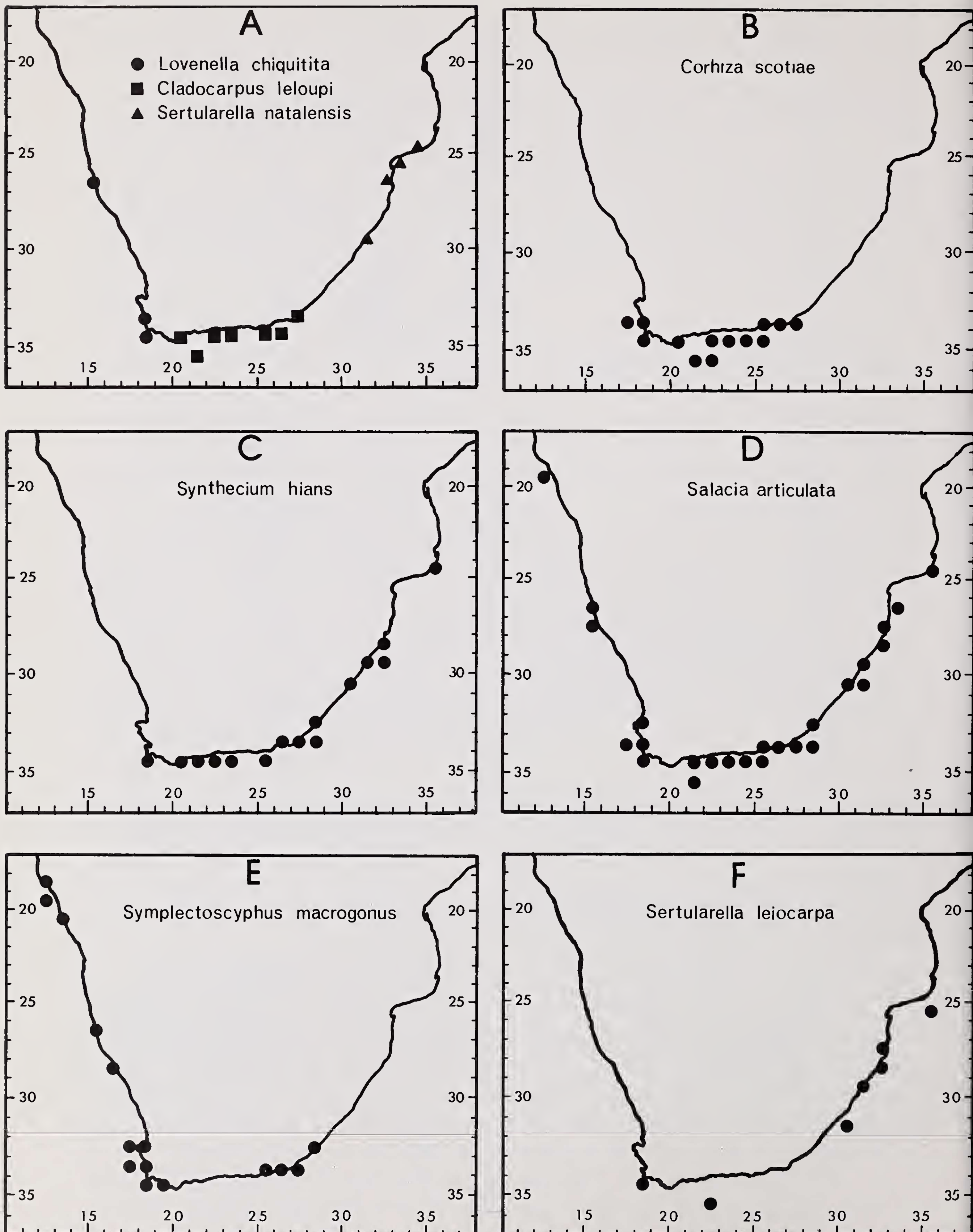


Fig. 8A–D. Distribution of six representative endemic species: A. *Lovenella chiquitita* (west coast + False Bay), *Cladocarpus leloupi* (south coast) and *Sertularella natalensis* (east coast). B. *Corhiza scotiae* (west + south coast). C. *Synthecium hians* (south + east coast). D. *Salacia articulata* (west + south + east coast).
E–F. Distribution of two representative temperate species: E. *Symplectoscyphus macrogonus* (west + south coast). F. *Sertularella leiocarpa* (west + south + east coast), also stenothermic.

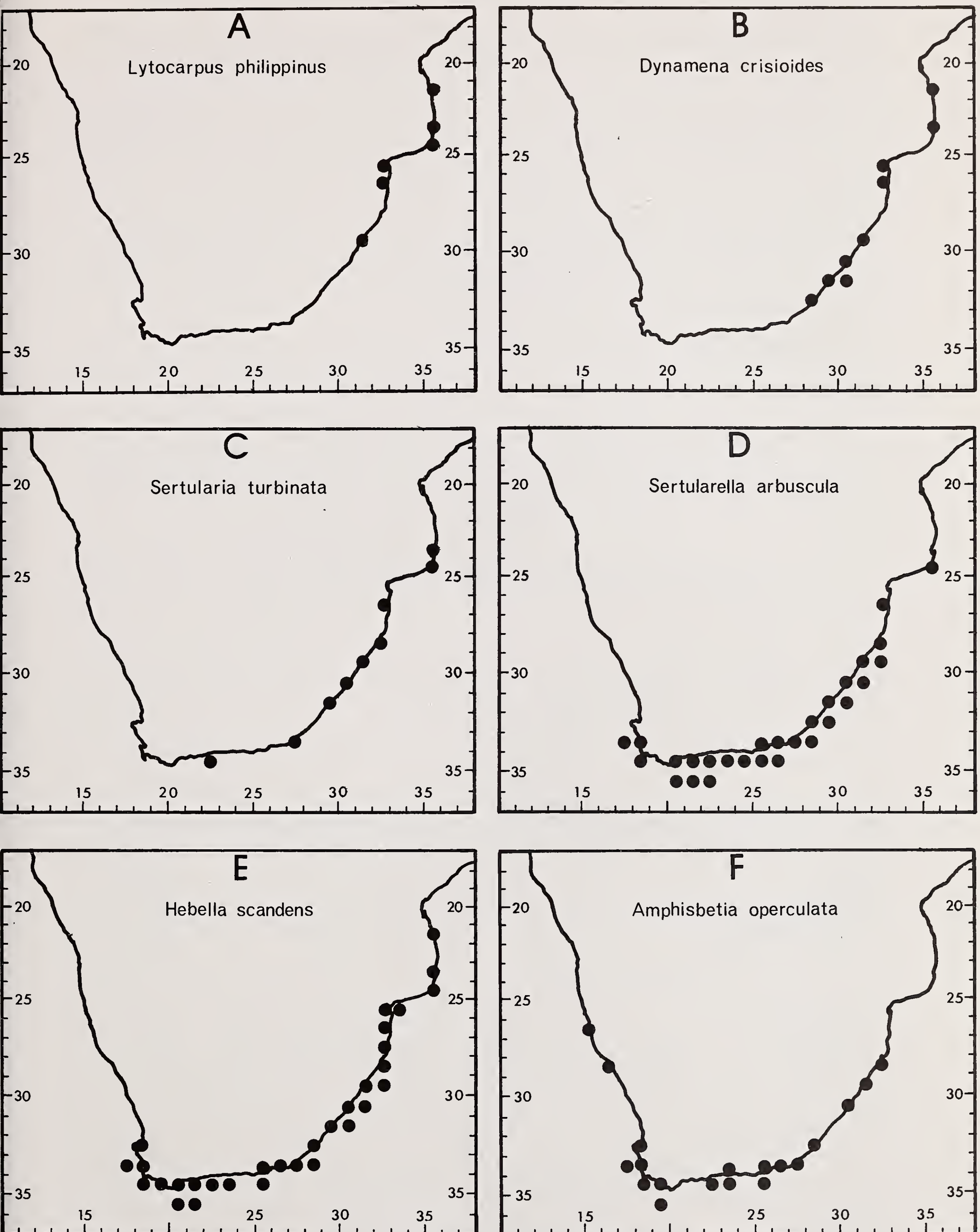


Fig. 9A–D. Distribution of four representative tropical species from east coast: A. *Lytocarpus philippinus* (to just north of Durban). B. *Dynamena crisioides* (to East London). C. *Sertularia turbinata* (to Mossel Bay). D. *Sertularella arbuscula* (to Saldanha Bay).
E–F. Distribution of two representative cosmopolitan species: E. *Hebella scandens* (St Helena Bay to Mozambique). F. *Amphisbetia operculata* (Lüderitz to Natal).

Lake St Lucia North in 10,4–10,8 parts per thousand.

CONCLUSION

The composition of the southern African hydroid fauna is summarized in Table 8, whence it can be seen that there is a mixture of endemic, tropical, temperate and cosmopolitan species in that order of abundance.

The presence of a large endemic population, the particular distribution of some of the Western Indian Ocean tropical species (p. 169), and the apparent proliferation of subspecies in certain genera (p. 173), all point to an active evolutionary centre in the South African area.

It is clear that there has also been a heavy invasion of tropical species from the Indo-West-Pacific region, and these species form the major component of the fauna of the east coast.

Regarding the temperate and cosmopolitan species, and considering

(i) the low relationship of the South African temperate fauna to that of the antarctic and subantarctic regions on the one hand, and to that of South America and Australasia on the other,

(ii) the practically certain role of ships in the introduction of at least three species out of 251 (1,2 %) to South Africa within a period of some 300 years (p. 170),

TABLE 8

Summary of analysis of geographical components of South African hydroid fauna (from actual records, not range).

Component	*West-plus-south coast: Sectors 1–23* (171 species)			*East coast: Sectors 24–34* (182 species)			*Whole of South Africa: Sectors 1–34* (251 species)		
	No.	Percentage		No.	Percentage		No.	Percentage	
TROPICAL									
Circumtropical	10	5,8	19,3	18	9,9	39,6	20	8,0	30,7
Indo-West-Pacific	7	4,1		23	12,6		24	9,6	
W. Indian Ocean	16	9,4		31	17,0		33	13,1	
TEMPERATE									
Antitropical	10	5,8	13,4	5	2,7	6,5	11	4,4	11,2
Southern	8	4,7		5	2,7		10	4,0	
Atlantic	5	2,9		2	1,1		7	2,8	
ENDEMIC									
To one area only	35	20,5	38,0	17	9,3	25,8	52	20,7	32,7
To the whole of South Africa	30	17,5		30	16,5		30	12,0	
UNCLASSIFIED									
Cosmopolitan	22	12,9	29,3	28	15,4	28,0	28	11,2	25,5
Scattered	28	16,4		23	12,6		36	14,3	

(iii) the fact that drifting weed and flotsam has probably performed a similar role throughout the ages,

it is hardly necessary to evoke the Theory of Continental Drift to explain the distribution.

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APPENDIX 1

List of new hydroid records identified by the author since the publication of Millard (1975, 1977*a*, 1977*b*) and incorporated in this paper.

FOREIGN (South African species recorded outside the country)

Family and species	*Locality data*	*SAM no.*
Solanderiidae		
Solanderia minima (Hickson, 1903)	Tulear, Madagascar; submitted by J. Bouillon, 1976	
Lafoeidae		
Filellum serratum (Clarke, 1879)	Vema Seamount; coll. J. R. Grindley	H 1653
Lafoea dumosa (Fleming, 1820)	South Georgia; coll. P. A. Hulley	H 2912
Campanulariidae		
Obelia bidentata Clarke, 1875	Nightingale Island; coll. Tristan Investments	H 1990
Plumulariidae		
Aglaophenia pluma parvula Bale, 1882	Gough Island, dredged; coll. Tristan Investments	H 1948
Antennella quadriaurita Ritchie, 1909	Nightingale Island; Tristan; coll. Tristan Investments	H 1991, 1949

SOUTH AFRICAN (N.B. Records are taken as 'new' if they have not been recorded before from the particular latitude/longitude square)
*—new record for South Africa. MD—from *Meiring Naude*, Cruise 3. Depths: l—littoral; s—1 to 99 m; md—100 to 199 m; d—200 to 499 m; vd—500 to 999 m; a—1 000+ m.

Family and species	*Locality data, including S—latitude/E—longitude square*	*SAM no.*
Bougainvilliidae		
Garveia crassa (Stechow, 1923)	Off Natal: 30/30 (vd); MD	H 2933
Pandeidae		
Hydrichthys boycei Warren, 1916	Eastern Cape: 33/27 (s), 33/26; on *Acanthurus lineolatus* and *Chirodactylus brachydactylus*; coll. R. Winterbottom	H 1970, 1985
Campanulinidae		
Stegolaria geniculata (Allman, 1888)	Off Natal: 30/30 (vd); MD	H 2943
Haleciidae		
Halecium beanii (Johnston, 1838)	Sodwana Reef: 27/32 (s); coll. A. E. Louw. Off Natal: 30/30 (vd); MD	H 2935, 2897
H. delicatulum Coughtrey, 1876	Jeffreys Bay: 34/24; coll. Mrs C. Giles	
H. dichotomum Allman, 1888	Hermanus, on beach: 34/19	
H. inhacae Millard, 1958	South of Sodwana: 27/32; coll. A. E. Louw	H 2891
H. tenellum Hincks, 1861	Hermanus, on beach: 34/19. Off Natal: 30/30 (vd); 31/30 (vd); MD	H 2934, 2938

APPENDIX 1 (continued)

Family and species	Locality data, including S—latitude/E—longitude square	SAM no.
Lafoeidae		
Acryptolaria conferta (Allman, 1877)	Off Cape Town: 34/16 (md–d). Off Natal: 30/30 (vd); MD	H 1986, 2941
**A. crassicaulis* (Allman, 1888)	Off Cape Town: 33/16 (a)	H 1988
A. rectangularis (Jarvis, 1922)	Off Natal: 30/30 (vd); MD	H 2929
Cryptolarella abyssicola (Allman, 1888)	Off Cape Town: 34/16 (md–d)	H 1987
Filellum serratum (Clarke, 1879)	Off Natal: 31/30 (vd); MD	H 2940
Hebella scandens (Bale, 1888)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	
Lafoea dumosa (Fleming, 1820)	Off Natal: 30/30 (vd); 31/30 (vd); MD	
Zygophylax africana Stechow, 1923	Off Natal: 30/30 (vd); MD	H 2944
Z. sibogae Billard, 1918	Off Natal: 30/30 (vd); MD	H 2930
Campanulariidae		
Clytia gravieri (Billard, 1904)	Sodwana Reef: 27/32 (s); coll. A. E. Louw. Off Cape Town: 34/17 (s); coll. Divn Sea Fisheries	H 2894, 2927
Obelia dichotoma (Linnaeus, 1758)	Hermanus, on beach: 34/19	
O. geniculata (Linnaeus, 1758)	Hermanus, on beach: 34/19	
Sertulariidae		
Amphisbetia maplestonei (Bale, 1884)	Jesser Point: 27/32 (l); coll. A. E. Louw. East London: 32/28; submitted by East London Museum	H 2895
A. minima (Thompson, 1879)	South of Sodwana: 27/32 (l); coll. A. E. Louw	H 2904
Diphasia digitalis (Busk, 1852)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2898
D. tetraglochina Billard, 1907	South of Sodwana: 27/32 (l); coll. A. E. Louw	H 2903
Salacia articulata (Pallas, 1766)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	
Sertularella diaphana (Allman, 1886)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2888
S. fusiformis (Hincks, 1861)	Stanford Bay: 34/19	
S. leiocarpa (Allman, 1888)	Off Natal: 31/30 (vd); MD	H 2937
S. mediterranea asymmetrica Millard, 1958	South of Sodwana: 27/32 (l); coll. A. E. Louw	H 2882
S. m. mediterranea Hartlaub, 1901	Sodwana Reef: 27/32 (s); coll. A. E. Louw	
Sertularia distans (Lamouroux, 1816)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2896
S. ligulata Thornely, 1904	South of Sodwana: 27/32 (l); coll. A. E. Louw	H 2905
S. longa Millard, 1958	South of Sodwana: 27/32 (l); coll. A. E. Louw	H 2909
Symplectoscyphus amphoriferus (Allman, 1877)	Off Natal: 30/30 (vd); MD	H 2931

APPENDIX 1 (continued)

Family and species	*Locality data, including S—latitude/E—longitude square*	*SAM no.*
Plumulariidae		
Aglaophenia pluma dichotoma (M. Sars, 1857)	Sandwich Harbour: 23/14 (s); coll. B. Kensley	
A. p. parvula Bale, 1882	South of Sodwana: 27/32; coll. A. E. Louw	
Antennella quadriaurita Ritchie, 1909	Hermanus, on beach: 34/19	
A. secundaria (Gmelin, 1791)	South of Sodwana: 27/32; coll. A. E. Louw	
Cladocarpus natalensis Millard, 1977	Off Natal: 30/30 (vd); MD	H 2942
Gattya multithecata (Jarvis, 1922)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2901
Gymnangium gracilicaule lignosum (Millard, 1968)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2885
Halopteris polymorpha (Billard, 1913)	Off Natal: 30/30 (vd); MD	H 2932
Lytocarpus filamentosus (Lamarck, 1816)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2884
L. phoeniceus (Busk, 1852)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2886
Monostaechas natalensis Millard, 1958	Agulhas Bank: 33/26 (d)	H 309
M. quadridens (McCrady, 1858)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	
Plumularia filicaulis Kirchenpauer, 1876	South of Sodwana: 27/32 (l); coll. A. E. Louw. Near Lüderitz Bay: 26/14 (s)	H 2906, 2750
P. obliqua (Johnston, 1847)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2889
P. pulchella Bale, 1882	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2907
P. setacea (Linnaeus, 1758)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	
Pycnotheca mirabilis (Allman, 1883)	South of Sodwana: 27/32 (s); coll. A. E. Louw	H 2890
Thecocarpus flexuosus flexuosus (Lamouroux, 1816)	Sodwana Reef: 27/32 (s); coll. A. E. Louw	H 2887

Appendix 2

List of species and their distribution round the coast of southern Africa. For position of sectors see Figure 1.

Depths: *l*—littoral; *s*—1 to 99 m; *md*—100 to 199 m; *d*—200 to 499 m; *vd*—500 to 999 m; *a*—over 1 000 m; *sh*—ships' hulls or floating objects.
The vertical lines indicate the boundaries between the west/south coast and the south/east coast.

NAME	CATEGORY	SECTORS																																		DEPTH						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Abietinaria laevimarginata (Ritchie, 1907)	Tropical: W.Ind.Oc.																											×	×	×						×	×					
Acryptolaria conferta (Allman, 1877)	Cosmopolitan										×				×	×		×	×		×				×	×	×	×				×					×	×	×	×	×	
Acryptolaria crassicaulis (Allman, 1888)	Scattered													×																											×	
Acryptolaria rectangularis (Jarvis, 1922)	Tropical: W.Ind.Oc.																								×	×	×	×		×		×						×	×	×	×	
Aequorea africana Millard, 1966	Endemic: S+E coast																	×												×							×					
Aglaophenia cupressina Lamouroux, 1816	Tropical: Ind.W.Pac.																																		×							
Aglaophenia latecarinata Allman, 1877	Scattered																							×	×	×	×					×					×					
Aglaophenia pluma dichotoma (M. Sars, 1857)	Scattered	×			×										×	×	×	×	×	×	×	×														×	×	×				
Algaophenia pluma parvula Bale, 1882	Scattered								×			×			×	×				×		×	×	×	×	×		×								×	×					
Aglaophenia pluma pluma (Linnaeus, 1758)	Cosmopolitan			×					×							×		×						×	×	×		×	×							×	×					
Amphisbetia maplestonei (Bale, 1884)	Tropical: W.Ind.Oc.															×		×	×	×	×	×	×	×	×	×	×	×								×	×					
Amphisbetia minima (Thompson, 1879)	Temperate: antitropical														×	×		×										×		×						×	×					
Amphisbetia operculata (Linnaeus, 1758)	Cosmopolitan								×		×				×	×	×	×	×	×	×	×	×		×	×	×									×	×	×				×
Antennella quadriaurita Ritchie, 1909	Scattered								×						×	×	×	×	×	×	×	×	×				×	×	×							×	×	×	×	×		
Antennella secundaria (Gmelin, 1791)	Cosmopolitan																×	×		×	×	×			×	×	×	×		×		×	×		×	×	×	×				
Asyncoryne ryniensis Warren, 1908	Tropical: W.Ind.Oc.																								×											×						
Bicorona elegans Millard 1966	Endemic: W+S coast														×							×														×						
Bimeria fluminalis Annandale, 1915	Tropical: Ind.W.Pac.																										×	×								×						

Bimeria rigida Warren, 1919	Endemic: S coast											×										×						
Bimeria vestita Wright, 1859	Cosmopolitan	×		×	×	×		×	×	×								×					×					
Bougainvillia macloviana (Lesson, 1830)	Scattered		×		×																		×					×
Bougainvillia meinertiae Jäderholm, 1923	Endemic: S coast				×																		×					
Branchiocerianthus imperator (Allman, 1885)	Tropical: Ind.W.Pac.																		×								×		
Calamphora campanulata (Warren, 1908)	Tropical: Ind.W.Pac.											×	×									×						
Calicella oligista Ritchie, 1910	Tropical: Ind.W.Pac.						×																	×				
Campanularia africana Stechow, 1923	Tropical: Ind.W.Pac.												×			×						×	×					
Campanularia calceolifera Hincks, 1871	Temperate: Atlantic		×	×																			×					×
Campanularia crenata (Hartlaub, 1901)	Cosmopolitan																	×		×			×					
Campanularia hincksii Alder, 1856	Cosmopolitan									×	×					×							×		×			
Campanularia integra MacGillivray, 1842	Cosmopolitan		×	×		×	×	×		×			×	×				×				×	×	×				
Campanularia laminacarpa Millard, 1966	Endemic:			×	×	×		×	×	×	×			×				×		×			×	×	×			
Campanularia morgansi Millard, 1957	Tropical: W.Ind.Oc.		×	×		×		×		×	×		×	×	×			×					×	×	×			
Campanularia pecten Gow & Millard, 1975	Endemic: W+S coast		×	×																		×	×					
Campanularia roberti Gow & Millard, 1975	Endemic: W+S coast		×	×																		×						
Cladocarpus crepidatus Millard, 1975	Endemic: S coast					×																			×			
Cladocarpus distomus Clarke, 1907	Circum-tropical												×	×		×	×			×	×				×	×	×	
Cladocarpus dofleini (Stechow, 1911)	Tropical: W.Ind.Oc.													×		×									×	×		
Cladocarpus inflatus Vervoort, 1966	Endemic: E coast													×											×			
Cladocarpus leloupi Millard, 1962	Endemic: S coast				×	×	×	×	×	×													×	×				
Cladocarpus lignosus (Kirchenpauer, 1872)	Endemic: S+E coast			×	×		×	×	×	×	×			×									×	×				

APPENDIX 2 (continued)

NAME	CATEGORY	SECTORS 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	DEPTH *l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Cladocarpus millardae Vervoort, 1966	Tropical: W.Ind.Oc.																	×								×		×				×							×	×		
Cladocarpus natalensis Millard, 1977	Endemic: E coast																								×			×											×	×		
Cladocarpus paries Millard, 1975	Endemic: S coast																					×															×					
Cladocarpus sinuosus Vervoort, 1966	Endemic: S+E coast																	×	×							×		×										×	×	×		
Cladocarpus tenuis Clarke, 1879	Scattered																									×													×			
Cladocarpus unicornus Millard, 1975	Endemic: E coast																															×						×				
Cladocarpus valdiviae Stechow, 1923	Endemic: S coast																	×																				×	×			
Cladocoryne floccosa Rotch, 1871	Cosmopolitan																								×				×	×						×						
Clavactinia multitentaculata Millard, 1975	Endemic: S+E coast															×										×											×					
Clavopsella navis (Millard, 1959)	Temperate: Atlantic														×																											×
Clytia gravieri (Billard, 1904)	Circum-tropical														×					×						×		×	×	×			×		×	×	×	×		×		
Clytia hemisphaerica (Linnaeus, 1767)	Cosmopolitan														×	×	×	×	×	×	×	×	×	×	×	×	×	×		×			×		×	×	×	×				×
Clytia hummelincki (Leloup, 1935)	Scattered																			×																						×
Clytia latitheca Millard & Bouillon, 1973	Tropical: W.Ind.Oc.																												×													
Clytia paradoxa (Stechow, 1923)	Endemic: S coast																×			×																		×				
Clytia paulensis (Vanhöffen, 1910)	Scattered																×	×	×	×			×			×	×	×		×							×	×	×			
Clytia warreni Stechow, 1919	Endemic: S coast																			×																	×					
Corhiza bellicosa Millard, 1962	Endemic: S coast																			×		×															×					
Corhiza mortenseni Millard, 1968	Endemic: S+E coast																				×				×	×											×	×	×			
Corhiza pannosa Millard 1962	Endemic: W+S coast														×	×			×	×		×	×														×	×				
Corhiza scotiae (Ritchie, 1907)	Endemic: W+S coast														×	×	×	×	×	×	×	×															×	×				

Corhiza valdiviae (Stechow, 1923)	Endemic: W+S+E coast	×			×	×		×	×	×	×		×									×					×	×	×			
Corydendrium parasiticum (Linnaeus, 1767)	Tropical: Ind.W.Pac.															×				×						×						×
Coryne pusilla Gaertner, 1774	Cosmopolitan														×					×						×						
Crateritheca acanthostoma (Bale, 1882)	Tropical: W.Ind.Oc.													×	×	×	×									×	×					
Cryptolarella abyssicola (Allman, 1888)	Scattered			×	×			×																				×	×		×	
Cryptolaria pectinata (Allman, 1888)	Scattered											×				×											×					
Cytaeis nassa (Millard, 1959)	Tropical: W.Ind.Oc.																			×												
Dentitheca bidentata (Jäderholm, 1920)	Tropical: W.Ind.Oc.																	×		×							×					
Dicoryne conferta (Alder, 1856)	Temperate: Atlantic					×	×	×																			×	×				
Dictyocladium coactum Stechow, 1923	Endemic: S+E coast					×		×		×	×	×	×				×										×	×				
Diphasia digitalis (Busk, 1852)	Circum-tropical																	×		×							×					
Diphasia heurteli Billard, 1924	Tropical: W.Ind.Oc.															×	×						×				×	×				
Diphasia tetraglochina Billard, 1907	Tropical: W.Ind.Oc.											×						×		×						×	×					
Dynamena cornicina McCrady, 1858	Cosmopolitan									×				×						×					×	×	×					
Dynamena crisioides Lamouroux, 1824	Circum-tropical												×	×	×	×				×			×		×	×	×					
Dynamena obliqua Lamouroux, 1816	Tropical: Ind.W.Pac.														×	×	×			×							×					
Dynamena quadridentata (Ellis & Solander, 1786)	Circum-tropical													×	×	×		×	×	×			×		×	×	×					
Ectopleura bethae (Warren, 1908)	Tropical: W.Ind.Oc.														×					×						×						
Egmundella amirantensis Millard & Bouillon, 1973	Tropical: W.Ind.Oc.																			×					×							
Eudendrium angustum Warren, 1908	Tropical: W.Ind.Oc.									×																	×					
Eudendrium capillare Alder, 1856	Scattered														×					×					×	×						

APPENDIX 2 (continued)

NAME	CATEGORY	SECTORS																																		DEPTH						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Eudendrium carneum Clarke, 1882	Circum-tropical																									×							×			×	×					×
Eudendrium deciduum Millard, 1957	Endemic: W+S coast														×	×		×		×																	×					
Eudendrium motzkossowskae Picard, 1951	Temperate: Atlantic																													×			×		×		×					
Eudendrium ramosum (Linnaeus, 1758)	Cosmopolitan														×	×				×		×	×							×						×	×					
Eudendrium ritchiei Millard, 1975	Endemic: W coast														×																					×						
Filellum antarcticum (Hartlaub, 1904)	Temperate: southern																	×																			×					
Filellum serratum (Clarke, 1879)	Cosmopolitan														×	×		×		×					×		×	×				×					×	×	×	×		
Garveia crassa (Stechow, 1923)	Tropical: W.Ind.Oc.																								×				×											×		
Gattya conspecta (Billard, 1907)	Tropical: W.Ind.Oc.																								×												×					
Gattya heurteli (Billard, 1907)	Tropical: W.Ind.Oc.														×										×	×	×			×		×					×					
Gattya humilis Allman, 1886	Endemic: W+S+E coast														×	×		×		×	×	×	×	×	×											×	×					
Gattya multithecata (Jarvis, 1922)	Tropical: W.Ind.Oc.																								×			×									×					
Gonothyraea loveni (Allman, 1859)	Temperate: antitropical														×																						×					×
Gymnangium africanum (Millard, 1958)	Endemic: E coast																								×		×										×					
Gymnangium allmanii (Marktanner, 1890)	Scattered																									×		×		×							×					
Gymnangium arcuatum (Lamouroux, 1816)	Scattered										×							×	×	×		×	×	×	×	×	×	×								×	×					
Gymnangium exsertum (Millard, 1962)	Endemic: S coast																			×	×		×														×	×				
Gymnangium ferlusi (Billard, 1901)	Tropical: W.Ind.Oc.																							×	×			×									×					
Gymnangium g. gracilicaule (Jäderholm, 1903)	Tropical: Ind.W.Pac.														×											×		×		×		×					×		×			
Gymnangium g. lignosum (Millard, 1968)	Tropical: Ind.W.Pac.																								×		×	×		×					×		×	×				

Gymnangium hians (Busk, 1852)	Circum-tropical																	×													×					
Halecium beanii (Johnston, 1838)	Cosmopolitan	×						×	×		×		×	×	×	×	×	×			×								×	×	×		×		
Halecium delicatulum Coughtrey, 1876	Cosmopolitan				×			×	×	×	×	×	×	×	×	×			×						×				×	×	×	×			
Halecium dichotomum Allman, 1888	Endemic: W+S+E coast	×						×	×	×	×	×	×	×	×	×			×						×					×	×	×			
Halecium dyssymetrum Billard, 1929	Circum-tropical																								×					×					
Halecium halecinum (Linnaeus, 1758)	Cosmopolitan														×								×							×					
Halecium inhacae Millard, 1958	Endemic: E coast																				×		×												
Halecium lankesteri (Bourne, 1890)	Scattered																						×					×	×						
Halecium sessile Norman, 1867	Cosmopolitan																		×													×			
Halecium tenellum Hincks, 1861	Cosmopolitan								×	×	×		×	×	×	×		×	×	×	×		×							×	×	×	×		
Halocordyle disticha (Goldfuss, 1820)	Circum-tropical																	×	×			×	×			×		×	×	×					×
Halopteris gemellipara Millard, 1962	Endemic: S+E coast												×	×	×	×			×											×	×				
Halopteris glutinosa (Lamouroux, 1816)	Tropical: W.Ind.Oc.										×		×	×	×	×	×	×	×	×	×		×						×	×	×	×	×		
Halopteris polymorpha (Billard, 1913)	Tropical: Ind.W.Pac.																	×	×	×	×		×					×		×		×	×		
Halopteris pseudoconstricta Millard, 1975	Endemic: W+S coast							×	×		×		×			×	×												×	×					
Halopteris rostrata Millard, 1975	Endemic: E coast																			×										×	×				
Halopteris tuba (Kirchenpauer, 1876)	Endemic: S+E coast								×	×	×	×	×	×	×	×		×	×						×					×	×	×	×		
Hebella dispolians (Warren, 1909)	Endemic: E coast																	×																	
Hebella furax Millard, 1957	Tropical: W.Ind.Oc.								×		×		×		×	×		×					×			×				×					
Hebella parvula (Hincks, 1853)	Temperate: Atlantic									×																					×				
Hebella scandens (Bale, 1888)	Cosmopolitan							×	×	×	×	×	×	×	×	×	×	×	×	×	×		×		×	×		×	×	×	×				
Hincksella corrugata Millard, 1958	Tropical: W.Ind.Oc.																	×					×					×		×					

Appendix 2 (continued)

NAME	CATEGORY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
		SECTORS																																		DEPTH						
Hincksella cylindrica (Bale, 1888)	Circum-tropical																					×															×					
Hincksella echinocarpa (Allman, 1888)	Temperate: southern																																×	×							×	
Hybocodon unicus (Browne, 1902)	Scattered														×																					×						
Hydractinia altispina Millard, 1955	Scattered								×		×				×	×																				×	×					
Hydractinia canalifera Millard, 1957	Endemic: S coast															×																				×						
Hydractinia diogenes Millard, 1959	Endemic: E coast																													×			×				×					
Hydractinia kaffraria Millard, 1955	Tropical: W.Ind.Oc.																×	×		×	×	×				×										×	×					
Hydractinia marsupialia Millard, 1975	Endemic: W+S coast														×	×	×	×	×	×																	×					
Hydrichthys boycei Warren, 1916	Endemic: S+E coast																				×					×										×	×					
Hydrocorella africana Stechow, 1921	Endemic: W+S+E coast										×		×		×	×	×	×	×	×						×										×	×	×		×		
Hydrodendron caciniformis (Ritchie, 1907)	Circum-tropical															×							×													×	×					
Hydrodendron cornucopia (Millard, 1955)	Endemic: W+S+E coast														×	×		×		×		×	×	×	×	×	×									×	×					
Hydrodendron gardineri (Jarvis, 1922)	Tropical: Ind.W.Pac.																													×			×				×					
Hydrodendron gracilis (Fraser, 1914)	Scattered														×																						×					
Hydrodendron sympodiformis Millard & Bouillon, 1974	Endemic: E coast																													×												
Idiellana pristis (Lamouroux, 1816)	Circum-tropical																								×					×					×		×					
Kirchenpaueria irregularis (Millard, 1958)	Endemic: E coast																									×									×	×						
Kirchenpaueria pinnata (Linnaeus, 1758)	Scattered			×								×			×	×	×	×		×		×	×	×		×										×	×					×
Kirchenpaueria triangulata (Totton, 1930)	Temperate: southern														×				×							×	×	×	×			×						×	×	×	×	
Lafoea benthophila Ritchie, 1909	Scattered																									×													×			

Lafoea dumosa (Fleming, 1820)	Cosmopolitan							×		×	×	×		×	×			×	×	×	×	×			×					×	×	×	×		
Leuckartiara octona (Fleming, 1823)	Scattered								×			×	×																	×					
Lineolaria gravierae Millard, 1975	Tropical: W.Ind.Oc.																						×												
Lovenella chiquitita Millard, 1957	Endemic: W+S coast	×						×	×																				×	×					×
Lytocarpus filamentosus (Lamarck, 1816)	Tropical: Ind.W.Pac.			×					×	×	×	×	×	×	×	×	×	×	×	×	×	×							×	×					
Lytocarpus philippinus (Kirchenpauer, 1872)	Circum-tropical																		×				×			×		×	×	×					
Lytocarpus phoeniceus (Busk, 1852)	Tropical: Ind.W.Pac.																		×		×									×					
Merona cornucopiae (Norman, 1864)	Scattered										×		×																	×					
Modeeria rotunda (Quoy & Gaimard, 1827)	Cosmopolitan																	×	×		×		×		×					×	×	×	×		
Monocoryne minor Millard, 1966	Endemic: S coast												×																	×					
Monostaechas faurei Millard, 1958	Endemic: S+E coast														×			×	×	×										×	×	×			
Monostaechas natalensis Millard, 1958	Endemic: S+E coast												×	×	×		×	×	×	×					×					×	×				
Monostaechas quadridens (McCrady, 1858)	Circum-tropical																×	×	×	×	×		×					×	×	×					
Myriothela capensis Manton, 1940	Endemic: W+S coast	×						×	×						×														×	×					
Myriothela tentaculata Millard, 1966	Endemic: W coast							×																						×					
Nemertesia antennina (Linnaeus, 1758)	Scattered																		×													×			
Nemertesia ciliata Bale, 1914	Temperate: antitropical					×	×	×		×	×	×	×																	×	×	×			
Nemertesia cymodocea (Busk, 1851)	Temperate: southern							×	×	×	×	×	×		×	×														×	×				
Nemertesia ramosa Lamouroux, 1816	Scattered							×	×		×	×	×					×	×		×				×					×	×	×	×		
Obelia bidentata Clarke, 1875	Cosmopolitan							×											×	×			×						×	×					×
Obelia dichotoma (Linnaeus, 1758)	Cosmopolitan			×			×	×	×	×	×	×	×						×				×			×		×	×	×	×				×
Obelia geniculata (Linnaeus, 1758)	Cosmopolitan	×						×	×	×													×						×	×					×

APPENDIX 2 (continued)

NAME	CATEGORY	SECTORS																																		DEPTH						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Oswaldella nova (Jarvis, 1922)	Tropical: W.Ind.Oc.														×			×	×		×	×			×		×								×		×	×				
Parascyphus simplex (Lamouroux, 1816)	Temperate: antitropical																								×												×					
Phialella turrita (Hincks, 1868)	Temperate: antitropical															×																										
Plumularia antonbruuni Millard, 1967	Endemic: E coast																									×													×			
Plumularia filicaulis Kirchenpauer, 1876	Temperate: antitropical							×	×						×	×												×		×			×			×	×					
Plumularia lagenifera Allman, 1886	Scattered								×		×				×	×		×																		×	×					
Plumularia mossambicae Millard, 1975	Endemic: E. coast																											×				×						×		×		
Plumularia obliqua (Johnston, 1847)	Temperate: antitropical																						×	×				×		×						×	×					
Plumularia pennycuikae Millard & Bouillon, 1973	Tropical: Ind.W.Pac.																																		×							
Plumularia pulchella Bale, 1882	Scattered														×	×	×	×		×		×	×			×	×	×								×	×	×				×
Plumularia setacea (Linnaeus, 1758)	Cosmopolitan								×						×	×	×	×	×	×		×	×	×	×	×	×	×		×					×	×	×		×			×
Plumularia spinulosa Bale, 1882	Temperate: antitropical															×		×		×		×	×	×	×	×										×	×					
Plumularia strictocarpa Pictet, 1893	Circum-tropical																																		×							
Plumularia warreni Stechow, 1919	Tropical: Ind.W.Pac.														×										×	×		×	×	×			×		×	×						
Plumularia wasini Jarvis, 1922	Tropical: W.Ind.Oc.																							×		×	×								×		×	×				
Pycnotheca mirabilis (Allman, 1883)	Scattered															×									×	×	×	×		×						×	×					
Rhizogeton nudum Broch, 1909	Scattered																													×					×							
Rhizorhagium robustum (Warren, 1907)	Tropical: W.Ind.Oc.																					×			×											×						
Salacia articulata (Pallas, 1766)	Endemic: W+S+E coast								×	×					×	×		×	×	×	×	×	×	×	×	×	×	×		×		×				×	×	×				
Salacia desmoides (Torrey, 1902)	Scattered																					×	×													×						

Salacia disjuncta Millard, 1964	Endemic: S coast								×						×	×															×					
Sarsia eximia (Allman, 1859)	Temperate: antitropical	×						×																						×	×					×
Scandia mutabilis (Ritchie, 1907)	Circum-tropical								×	×	×		×					×					×			×				×	×					
Schizotricha simplex Warren, 1914	Endemic: S coast									×	×				×		×													×						
Sertularella africana Stechow, 1919	Endemic: W+S+E coast							×	×	×	×		×		×	×		×												×	×					×
Sertularella agulhensis Millard, 1964	Endemic: S coast								×																						×					
Sertularella annulaventricosa Mulder & Trebilcock, 1915	Temperate: southern												×		×	×	×		×												×					
Sertularella arbuscula (Lamouroux, 1816)	Tropical: W.Ind.Oc.							×	×	×	×	×	×	×	×	×	×	×	×	×			×		×					×	×	×	×			
Sertularella capensis Millard, 1957	Endemic: S coast								×						×	×															×					
Sertularella congregata Millard, 1964	Endemic: S coast														×																×					
Sertularella diaphana (Allman, 1886)	Circum-tropical																	×	×		×		×								×					
Sertularella dubia magna Millard, 1958	Endemic: S+E coast								×	×			×	×	×	×		×	×	×	×										×	×	×			
Sertularella flabellum (Allman, 1886)	Endemic: W+S+E coast							×	×	×	×	×	×	×	×	×		×	×												×	×	×			
Sertularella fusiformis (Hincks, 1861)	Scattered							×	×		×				×	×														×	×					
Sertularella gilchristi Millard, 1964	Endemic: S coast												×	×	×																×					
Sertularella goliathus Stechow, 1923	Endemic: W+S coast							×	×	×	×																				×	×				
Sertularella leiocarpa (Allman, 1888)	Temperate: southern							×			×							×	×		×				×								×	×		
Sertularella m. asymmetrica Millard, 1958	Endemic: S+E coast										×				×						×		×							×	×					
Sertularella m. mediterranea Hartlaub, 1901	Scattered							×	×		×		×					×	×	×	×									×	×					
Sertularella megista Stechow, 1923	Endemic: W+S+E coast							×	×	×	×	×	×	×	×	×		×	×	×					×						×	×	×			

APPENDIX 2 (continued)

NAME	CATEGORY	SECTORS																																		DEPTH						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Sertularella natalensis Millard, 1968	Endemic: E coast																									×				×		×					×					
Sertularella p. falsa Millard, 1957	Endemic: S coast															×		×																			×					
Sertularella p. gigantea Hincks, 1874	Temperate: Atlantic																		×																			×				
Sertularella p. polyzonias (Linnaeus, 1758)	Cosmopolitan														×	×	×	×	×	×	×	×	×		×	×	×					×				×	×	×				
Sertularella p. xantha Stechow, 1923	Endemic: W+S+E coast														×	×	×	×	×	×		×				×											×	×	×			
Sertularella pulchra Stechow, 1923	Endemic: S coast															×		×	×	×	×	×	×														×	×				
Sertularella striata Stechow, 1923	Temperate: southern																×	×	×	×		×															×	×				
Sertularia distans (Lamouroux, 1816)	Circum-tropical															×	×	×		×		×	×	×	×	×	×	×		×		×	×		×	×	×					
Sertularia ligulata Thornely, 1904	Tropical: Ind.W.Pac.																											×		×			×		×	×	×					
Sertularia longa Millard, 1958	Tropical: W.Ind.Oc.																											×		×			×			×	×					
Sertularia marginata (Kirchenpauer, 1864)	Circum-tropical															×				×										×							×					
Sertularia turbinata (Lamouroux, 1816)	Circum-tropical																	×				×	×	×	×	×	×	×		×			×			×	×					
Solanderia minima (Hickson, 1903)	Tropical: W.Ind.Oc.																																		×							
Solanderia procumbens (Carter, 1873)	Endemic: W+S+E coast														×	×		×		×						×	×					×					×	×				
Sphaerocoryne bedoti Pictet, 1893	Tropical: Ind.W.Pac.																								×										×	×						
Staurocladia vallentini (Browne, 1902)	Temperate: southern								×						×	×																				×	×					
Stegolaria geniculata (Allman, 1888)	Tropical: Ind.W.Pac.																								×			×												×		
Stereotheca elongata (Lamouroux, 1816)	Temperate: antitropical																			×																						
Symplectoscyphus amphoriferus (Allman, 1877)	Scattered																								×			×												×		

Symplectoscyphus arboriformis (Marktanner, 1890)	Endemic: W+S+E coast									×				×	×	×	×		×	×	×	×			×	×										×	×	×			
Symplectoscyphus macrogonus (Trebilcock, 1928)	Temperate: southern	×							×		×				×	×				×	×	×	×													×	×					
Symplectoscyphus paulensis Stechow, 1923	Temperate: southern																									×	×	×				×							×	×	×	
Synthecium dentigerum Jarvis, 1922	Tropical: W.Ind.Oc.															×	×			×	×	×															×					
Synthecium hians Millard, 1957	Endemic: S+E coast															×	×	×	×	×	×	×	×		×	×	×					×					×	×	×			
Thecocarpus brevirostris (Busk, 1852)	Tropical: Ind.W.Pac.																									×	×	×		×			×				×					
Thecocarpus delicatulus (Busk, 1852)	Tropical: Ind.W.Pac.																																		×							
Thecocarpus f. flexuosus (Lamouroux, 1816)	Tropical: Ind.W.Pac.															×	×	×				×			×	×	×	×				×					×	×				
Thecocarpus f. plumiferus (Kirchenpauer, 1872)	Endemic: S coast																×			×	×	×	×														×	×				
Thecocarpus f. solidus (Millard, 1958)	Endemic: S+E coast																	×		×	×	×	×		×	×	×			×		×					×	×				
Thecocarpus f. umbellatus Millard, 1962	Endemic: S coast																	×		×	×	×	×														×	×				
Thecocarpus formosus (Busk, 1851)	Scattered										×							×	×	×	×	×	×	×	×	×	×									×	×					
Thyroscyphus aequalis Warren, 1908	Tropical: Ind.W.Pac.															×	×	×		×	×	×	×	×	×	×	×			×		×	×				×	×	×			
Thyroscyphus fruticosus (Esper, 1830)	Tropical: Ind.W.Pac.																													×						×						
Tubularia larynx Ellis & Solander, 1786	Temperate: antitropical														×		×																					×				×
Tubularia warreni Ewer, 1953	Endemic: W+S+E coast														×	×		×								×										×						×
Turritopsis nutricula McCrady, 1856	Cosmopolitan																													×			×		×		×					
Uniscyphus fragilis Millard, 1977	Endemic: E coast																										×												×			
Zygophylax africana Stechow, 1923	Endemic: W+S+E coast											×			×			×	×						×			×										×	×	×		
Zygophylax armata (Ritchie, 1907)	Scattered																					×			×	×	×	×				×					×	×	×			

APPENDIX 2 (continued)

NAME	CATEGORY	SECTORS																																DEPTH						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	*l*	*s*	*md*	*d*	*vd*	*a*	*sh*
Zygophylax brownei Billard, 1924	Temperate: Atlantic																											×											×	×		
Zygophylax geminocarpa Millard, 1958	Endemic: E coast																								×												×					
Zygophylax inconstans Millard, 1977	Endemic: E coast																										×	×											×			
Zygophylax infundibulum Millard, 1958	Endemic: E coast																									×												×	×			
Zygophylax sibogae Billard, 1918	Scattered																				×				×			×	×								×		×	×		
Zyzzyzus solitarius (Warren, 1906)	Scattered														×	×						×			×					×					×	×	×					